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COMPUTE!

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October
1986
Issue 77
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ISSN 0194-357X

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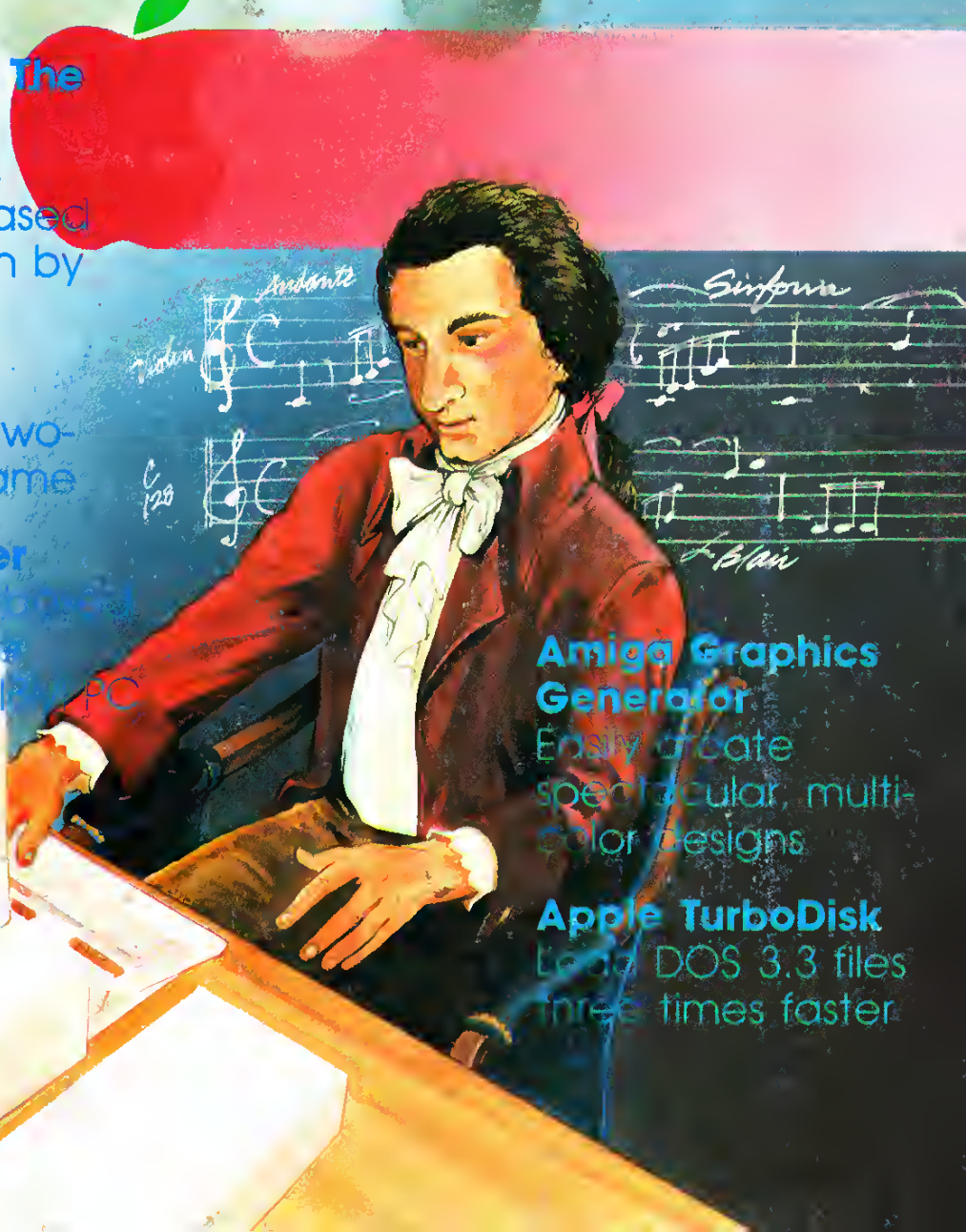

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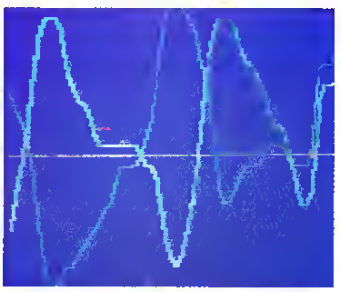

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OPERATING SYSTEM: Because GEOS orchestrates every function so that they all work together systematically, even symphonically.

Some basics. Icons are graphic images which represent files or utilities. Each is different, and all are easy to recognize and easy to use.

A menu is just that: a list of functions available for selection. When a menu appears, move the pointer to any item you wish. Click. Click. You're on your way.

A pointer is used to select and activate items. To move the pointer, roll the mouse or trackball or rotate the joystick. Once on target, click once to select; click a second time to activate.

Fonts are a new way of looking at text. Choose from 5 different fonts (with more on the way). Try Dwinelle, or Roma, **bold,** or *italics,* even underline and outline. Need to fit more words on a line? Pick a smaller point size, like University 6 point, and get over one hundred characters per line.

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GEOS can be divided into 4 areas: two functional aspects (deskTop and Desk Accessories), and two major applications (geoPaint and geoWrite).

deskTop. deskTop is a graphic interface, making file organization and management easy. As always, you call the shots. Load a disk. Files appear as icons on the disk notepad; to flip through, point at the folded corner and click. Prefer a file appear on a different sheet? Move it. It's easy.

Create a new document or re-name an existing one. Want to copy a file onto the same or a different disk? Fine. Forgotten what a file contains? Select "get info" from the file menu. A description of that file's contents appears. Finished with a file? Print it. Save it. Or drop it in the trash and have done with it. Your call.

geoPaint. A full-featured, color graphics workshop at your fingertips. The pointer operates any one of the fourteen graphic tools and shapes in the drawing menu. Create masterpieces on the Drawing Window. By turns, use a pencil, an airbrush or a paint brush, each with a character all its own. Draw straight lines, squares, rectangles or circles. Fill in with any of the 32 patterns. Switch to pixel-mode, where each dot in a selected section is magnified many times its size for easy manipulation.

own two Machines.

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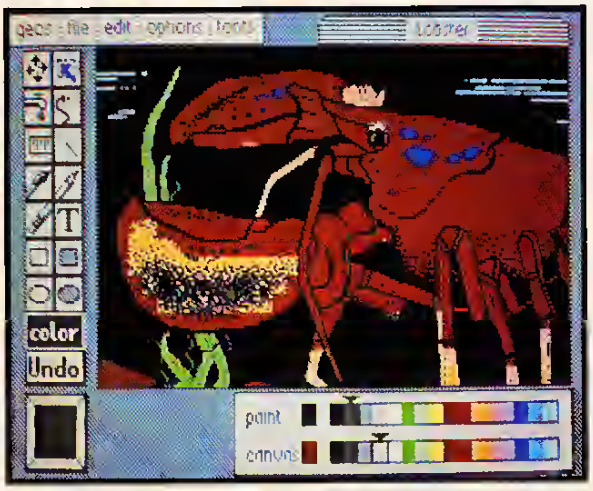
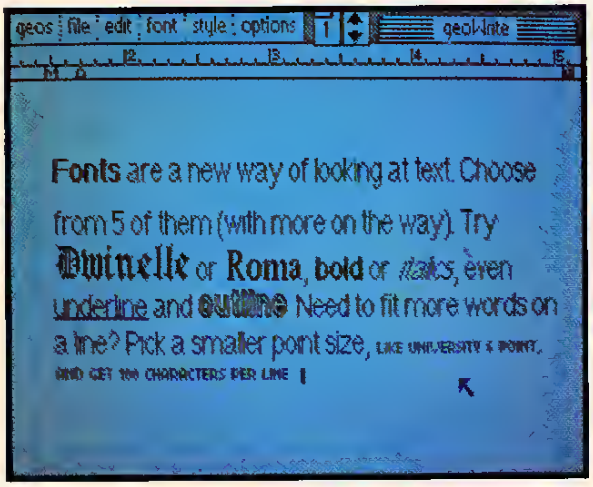


Second thoughts? Erase what you don't want. Or "UNDO" your last act. (If only life could imitate art!)

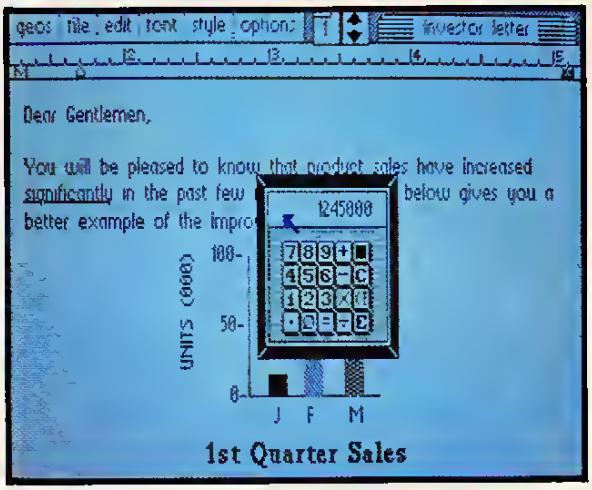
Add text if you like, in different fonts, styles or point sizes. Even change its position or layout at will.

Move or copy any part of your creation. Once done, you can include your artwork in another document—a letter home perhaps. (Won't Mother be pleased?) GEOS makes it easy.



geoWrite. An easy to use, "what you see is what you get" word processor. Create documents. Insert, copy, move or delete text as you wish. Choose from 5 different fonts in many different styles and point sizes. Preview your page exactly as it will appear off the printer. Typists will appreciate tabs, word-wrap and page breaks.

Documents may contain up to 64 pages. What's more, you can move to any page instantly. If you like, you can cut selected text from one section and move or copy it to another. Add graphics from geoPaint. It's a cinch.



Desk Accessories. Handy programs you can use while in any GEOS application. These include an alarm clock, a notepad for reminders, a four-function calculator, and photo and text albums which store pictures and phrases you may then paste into applications. The Preference Manager even lets you establish parameters for everything from mouse speed to the date and time—even background color. Civilized options, every one.

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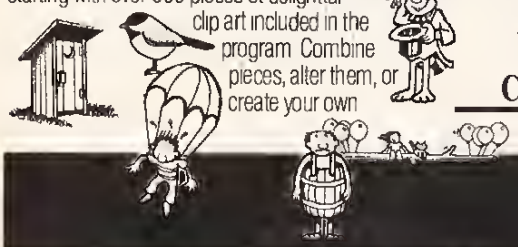

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COMPUTE!

OCTOBER 1986
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NUMBER 10
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FEATURES

REVIEWS

COLUMNS AND DEPARTMENTS

THE JOURNAL

NOTE See page 113 before typing in programs.

AP Apple **Mac** Macintosh **AT** Atari **ST,** Atari ST **V** VIC-20 **64** Commodore 64 **+4** Commodore Plus/4 **16** Commodore 16 **128** Commodore 128 **P** PET/CBM **TI** Texas Instruments **PC** IBM PC **PCjr** IBM PCjr, **AM** Amiga *General Interest

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Editor's Notes

An interesting phenomenon developed in response to our recent editorial critical of sluggish sales of the Commodore Amiga where we attributed this weakness to Commodore's targeting and marketing of the computers. Some readers wrote in to complain that we were being overly supportive of the ST; some wrote to complain that we were attacking the Amiga. We meant to do neither, and want to clarify those points.

We feel, quite strongly, that the Amiga from Commodore is one of the most technologically advanced personal computers available on the marketplace today. We feel equally strongly, given the features and design of the computer, that it should be a great success. The fact that it has not yet shown significant sales relative to, say, the Atari ST, indicates to us that the weakness in the marketing of the Amiga must derive from something other than the qualities the computer itself has to offer the buying public. Perhaps it's the targeting of the machine—perhaps the lack of aggressiveness with which it is being marketed.

None of this concern over the lessened acceleration of Amiga sales compared to those of the Atari ST reflects a lack of respect for the computer. As with the Atari ST, COMPUTE! Publications has been the industry leader in providing, for example, new book titles pertinent to the Amiga. Not only do we want the computer to succeed; we also want it to do quite well. And we share your disappointment that it has been a relatively slow starter.

Some of you have indicated in your letters that you are under the impression that the Amiga is outselling the Atari ST. This is simply not consistent with the information we've seen and heard over the months since the introduction of the two machines. Again, we are not responsible for the fact that the ST is outselling the Amiga. On the other hand, sales of the Amiga are beginning to show increases. As Nigel Shepherd pointed out in a recent GAZETTE interview, sales figures to date have been comparing an installed base of worldwide STs to an installed base of Amigas in the United States. This is a function of Atari's expansion into international markets ahead of Commodore. Commodore, as of late summer, is now marketing the Amiga in Europe, a market that should prove very strong indeed. And Commodore expects to be delivering approximately 10,000 units per month.

We wish success for both Commodore and Atari. To wish otherwise would be to suggest that we have a desire to self-limit our audience. Do not misunderstand our push for stronger, broader marketing efforts on behalf of the Amiga. We remain committed to the support of the machine. Every issue of COMPUTE! continues to provide useful applications. And our COMPUTE! Books division continues to provide timely new titles dedicated to the Amiga. For your part, you can keep those articles and programs coming. Until next issue, enjoy your COMPUTE!.

Robert C. Lock
Editor in Chief

GULF STRIKE IS A SMASH!

"Gulf Strike is an excellent, ambitious, demanding simulation and is certainly a feather in Microcomputer Games' cap. The exclusive joystick input device is a pleasure and the game's sound effects guide the player along as well. These features make the game immediately playable, with only a minimal scanning of the rules. The rules are well written and complete (with designer's notes), with interesting military data which explain in detail the natures of the armies and equipment simulated. The game explores a touchy subject and offers plausible insights into conflict in the region."

Ian Chadwick, Strategy & Tactics Magazine

"Game of the Month"
Jerry Pournelle, Byte

"Never slow and always completely involving. The result is a major leap forward for the genre, and the best computer wargame to date." Rating: ** (Excellent)**
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Oh, and just so you won't think we're bad sports, here's an enchanted sword. Hope you know how to use it.

Amiga
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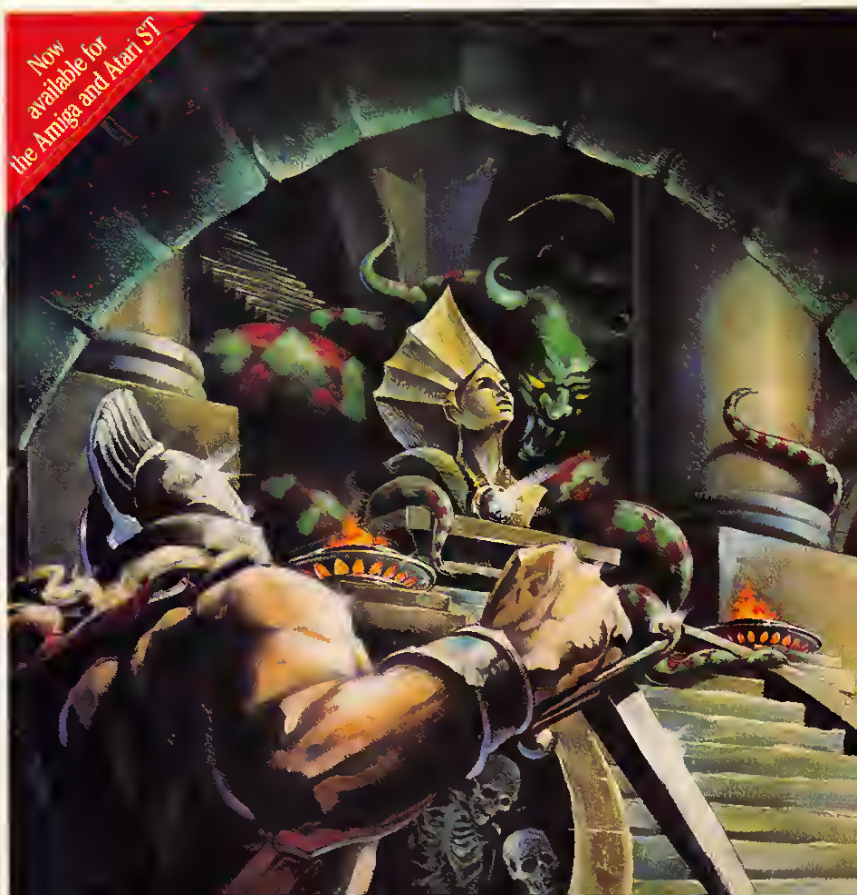

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Temple of Apshai Trilogy screen from Commodore 64®/128™ version of the game Rogue screen from the Atari ST™ version of the game. ©Epyx, Inc

Readers Feedback

The Editors and Readers of COMPUTE!

If you have any questions, comments, or suggestions you would like to see addressed in this column, write to "Readers' Feedback," COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Due to the volume of mail we receive, we regret that we cannot provide personal answers to technical questions.

Defining Power

I have just purchased an IBM PC–compatible computer for the purpose of running a long BASIC program, and now I know how the emperor must have felt about his new clothes. This program, which is approximately 20K long, uses an in-memory file of string variables which is about 40K long. It had previously been running on a Commodore 128 with a 1571 disk drive, and it was working perfectly. Since it was being used for an important aerospace industry application, I felt it was time to upgrade to a higher-powered computer.

We were able to use modems to transfer the program from one computer to the other; the problem came when we tried to run it. We found that it was dismally slow, and the GW-BASIC we were using would only allow 64K for program and data—hardly any room for expansion. We then purchased a more highly touted and supposedly higher-powered version of BASIC (promoted as running many times faster than other BASICs) and found that the compiled BASIC was still far slower than Commodore BASIC. I realize that I could speed up the program considerably by going to C or another more powerful language, but the increased power could only be achieved at the expense of user-friendliness.

We are now going to take one more shot at finding a more powerful version of BASIC or a compiled version of BASIC, but for the moment the conclusion is that none of the professional's tools can do the job as well as the hobbyist's tool we are currently using.

Stephen R. Collins

Since we don't have your program, it's impossible to account for the difference with certainty. However, the size of a particular computer's BASIC has a lot to do with how fast it runs. Because BASIC is an interpreted language (the computer looks up each statement individually as it runs the program), the number of BASIC keywords has a significant effect on how fast it runs. The longer the list of keywords, the more time it takes the computer to scan the list and find each one. Microsoft/IBM BASIC is roughly twice the size of the 128's BASIC 7.0, so it takes the PC more time to interpret and execute each statement. Similarly, BASIC 7.0 is four times as long as the Commodore 64's BASIC 2.0, so comparable BASIC programs run somewhat slower on the 128 than on the 64.

A second reason may be the efficiency of the microprocessor itself. The PC's 8088 processor has a more powerful and varied instruction set than the 128's 8502, plus a faster clock speed. However, most 8088 ML instructions take more than twice as many clock cycles to execute as corresponding 8502 instructions, so the advantage of the PC's faster clock speeds is much reduced. Thus, the 8502's simpler instruction set can lead to greater efficiency in some cases.

A third factor, which is much more difficult to quantify, has to do with the efficiency of individual BASIC statements. For instance, the PC's routines for printing to the screen also tend to be much slower than those used on the 128, which further reduces the speed of IBM BASIC programs that involve substantial video output. This factor, of course, depends to a large extent on which commands are used in a particular program.

Your letter describes one case where the 128 appears to outperform a much more expensive machine. But in other applications the opposite might be true. For instance, the PC and its clones can transfer data to and from disk a great deal faster than the 128. Even burst mode loading with a Commodore 1571 disk drive is considerably slower than normal loading on any MS-DOS machine. As a result, the PC can outrun the 128 significantly and consistently in any application that requires heavy disk access.

Because every machine has different strengths and weaknesses, it's extremely risky to evaluate a computer's capabilities on the basis of general assumptions. Thousands of people use so-called hobbyist computers for professional purposes, and thousands of others use so-called professional computers chiefly for entertainment. Perhaps the most useful definition of computer power is strictly functional: If a computer gets the job done in a way that satisfies your individual needs, then it's powerful—regardless of brand name or pricetag.

Your experience highlights a rule that we've emphasized many times: Before buying any piece of computer hardware or software, give it a thorough test under conditions that resemble your actual situation as closely as possible. If that's not practical—as it may not have been in your case—try to get specific advice from someone who already owns and uses the product in question. Local user groups are often an excellent source for this information.

BASIC Orphans

I own an Atari 800 computer and am trying to write a game. But I have problems when I try to use the variable COMP. For example, I get an error whenever I type COMP=32. I then try typing COMP (42). The computer just prints READY. Please tell me what this command is used for.

Brian Korn

Atari BASIC, like most early versions of the language, won't let you include reserved BASIC words as part of a variable name. For example, the variable FORCE cannot be used because it contains the embedded BASIC keyword FOR. The variable name COMP is illegal for exactly the same reason, even though the cause is less apparent. When Atari BASIC was written, many different commands were considered, but some of them had to be omitted because of memory limitations. The keyword COM is reserved but unimplemented in Atari BASIC (it would have been used to declare common variables).

Though COM doesn't perform its intended function, it is still recognized as a BASIC keyword and can't be used as part of a variable name. COM is diverted to the DIM command, so the statement COMP (42) has the same effect as DIM P(42). Since DIM requires a value in parentheses, the statement COMP=32 generates a syntax error when BASIC finds an equal

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sign (=) instead of a left parenthesis. This program PEEKs Atari BASIC ROM and prints all the BASIC statements and functions. As you'll see, COM is the only unimplemented keyword.

```
10 ADDR=42163:? :? "--STA
   TEMENTS--":?
20 IF  NOT PEEK(ADDR) THE
   N 50
30 BYTE=PEEK(ADDR):ADDR=A
   DDR+1:IF BYTE<128 THEN
    ? CHR$(BYTE);:GOTO 30
40 ? CHR$(BYTE-128):ADDR=
   ADDR+2:GOTO 20
50 ADDR=43049:? :? "--FUN
   CTIONS--":?
60 IF  NOT PEEK(ADDR) THE
   N END
70 BYTE=PEEK(ADDR):ADDR=A
   DDR+1:IF BYTE<128 THEN
    ? CHR$(BYTE);:GOTO 70
80 ? CHR$(BYTE-128):GOTO
   60
```

Orphan keywords occur in other versions of BASIC as well. For instance, BASIC 7.0 for the Commodore 128 tokenizes QUIT and OFF, but neither statement performs any function. The OFF keyword may have been intended as part of a KEY OFF statement similar to KEY OFF in BASICA for the IBM PC.

File Modes In *SpeedCalc* And *SpeedScript*

Your response to Stephen Forstein in the May 1986 installment of "Readers' Feedback" includes a program to convert a 64 *SpeedCalc* program file to a sequential (SEQ) file for use with the *Sideways* program. There is a much easier way to print sequential files to disk: Simply add ,S to the end of the filename. Although it's rarely mentioned, you can use the same trick to save a BASIC program as a sequential file. For instance, save a short BASIC program by entering this command in direct mode:

```
SAVE "0:TEST,S",8
```

The program appears on the directory as a SEQ file, but contains exactly the same data as if you'd saved it in the normal way. To load the file back into memory, enter this command:

```
LOAD "0:TEST,S",8
```

You can just as easily save the program as a mock USR file by replacing the *S* in the special SAVE command with a *U* (SAVE "0:TEST,U",8). To print a *SpeedCalc* file to disk as a sequential file, press SHIFT–CTRL-P. When you are prompted for a device, select D for disk. When you are prompted for a filename, add ,S to the end of the filename that you choose. *SpeedCalc* prints the spreadsheet to disk as a sequential file. I have used this method with *Sideways* and it works every time.

Daniel H. Sealy

Thanks for the advice. Since many telecommunications programs expect sequential files, this method can also be useful if you're transferring SpeedCalc *files from one computer to another over telephone lines or a null modem cable. Note that* SpeedScript, COMPUTE!*'s popular word processor, ordinarily creates program (PRG) files when* saving *a file to disk, and sequential (SEQ) files when* printing *to disk. By adding ,S or ,P after the filename as needed, you can select either file type at will.*

For instance, to print the file "TEST" as a PRG file, press SHIFT–CTRL-P and enter TEST,P when SpeedScript *prompts you for a filename. This operation stores "TEST" as an ASCII file in PRG format, which, again, might be handy for telecommunications or other special purposes.*

To save the file "TEST" as a SEQ file, press SHIFT-f7 and enter TEST,S when SpeedScript *prompts you for a filename. You can reload such a file by including ,S at the appropriate filename prompt.*

Tandy/PCjr Enhancement For "Screen Machine II"

I've just typed in the "Screen Machine II" program for the IBM PC (see COMPUTE!, July, 1986). I am impressed by the program. However, I don't like the delays caused by the use of GET and PUT. To speed up the program's execution, I switched the array UNDO% to a different page in graphics memory, then replaced GET and PUT statements with PCOPY statements. For example, PCOPY 0,1 stores the current picture. PCOPY 1,0 copies the stored image back, and so on. The use of multiple video pages makes the program run significantly faster, particularly when you choose a new tool.

The following program changes work on my 256K Tandy PC-compatible computer with GW-BASIC; they might also work on a 128K Tandy, but I have no way to test that configuration. Enter and save the program lines with the "Automatic Proofreader;" then load your existing copy of "Screen Machine II" and merge the new lines with a MERGE command. For instance, if you saved the new lines with the filename LINES, the command MERGE "LINES" would merge them with the main program. Delete line 410; then save the enhanced program under a new filename.

In addition, you may want to change line 2080 so that the variable SFLAG equals −1 rather than 0. This change prevents you from UNDOing the program's NEW command (ordinarily, a NEW can be recovered with UNDO). The variable SFLAG governs when to copy the screen to the backup screen when the top and bottom command areas are drawn.

```
LN 140 PCJR=0:ON ERROR GOTO 150:
       SOUND OFF:CLEAR ,,,65536'
       :DEFINT A-Z:PCJR=-1
OH 310 SMODE=1:COLR=1:SFLAG=-1:G
       OSUB 3000
QL 1020 IF MY>=CY THEN COLR=INT(
       MX/XR#)FOR II=1 TO 0 STE
       P-1:SCREEN ,,II:GOSUB 60
       00:NEXT:RETURN
JL 1030 PCOPY 0,1
JD 1250 PCOPY 1,0
KO 13B0 PCOPY 1,0
DF 1510 GOSUB 3000:PCOPY 1,0
GC 2060 GOSUB 19000:PCOPY 1,0:RE
       TURN
II 20B0 SFLAG=0:GOSUB 3000:RETUR
       N
LE 2150 PCOPY 0,1:RETURN
MH 2190 PCOPY 0,1:LINE(0,0)-(XRE
       S-1,YRES-1),0,B:LINE(0,0
       )-(XRES-1,B),0,BF:LINE(0
       ,YRES-12)-(XRES-1,YRES-1
       ),0,BF
MA 2210 ON ERROR GOTO 0:CLOSE#1:
       GOSUB 3000:PCOPY 1,0
MN 2250 PCOPY 0,1:LINE(0,0)-(XRE
       S-1,YRES-1),0,B:LINE(0,0
       )-(XRES-1,B),0,BF:LINE(0
       ,YRES-12)-(XRES-1,YRES-1
       ),0,BF
CH 22B0 GOSUB 3000:PCOPY 1,0:CUR
       SOR=-1:RETURN
EO 3020 SFLAG=-1:ON SMODE GOSUB
       3110,3150,3030,3030,3190
KH 30B0 GOSUB 6000:GOSUB 12000:I
       F SFLAG THEN PCOPY 0,1:S
       FLAG=0
FP 3110 SCREEN 1,,0,0,2:COLOR 0,
       1:COLR=1:XRES=320:YRES=2
       00:BG=0:MAXCOLOR=4
BE 3150 SCREEN 2,,0,0,2:XRES=640
       :YRES=200:MAXCOLOR=2:COL
       R=1
PB 3190 SCREEN 5,,0,0,2:XRES=320
       :YRES=200:MAXCOLOR=16:CO
       LR=1
GM 4000 GOSUB 19000:PCOPY 0,1
JF 4060 PCOPY 1,0
CN 5510 GOSUB 19000:PCOPY 0,1
KO 5570 PCOPY 1,0
```

Kevin O'Donovan

Thanks for the enhancement, which also works on the PCjr with cartridge BASIC. Since BASICA for the PC does not have a PCOPY command, this method can't be used on the PC or PC-compatible computers whose BASIC doesn't support PCOPY.

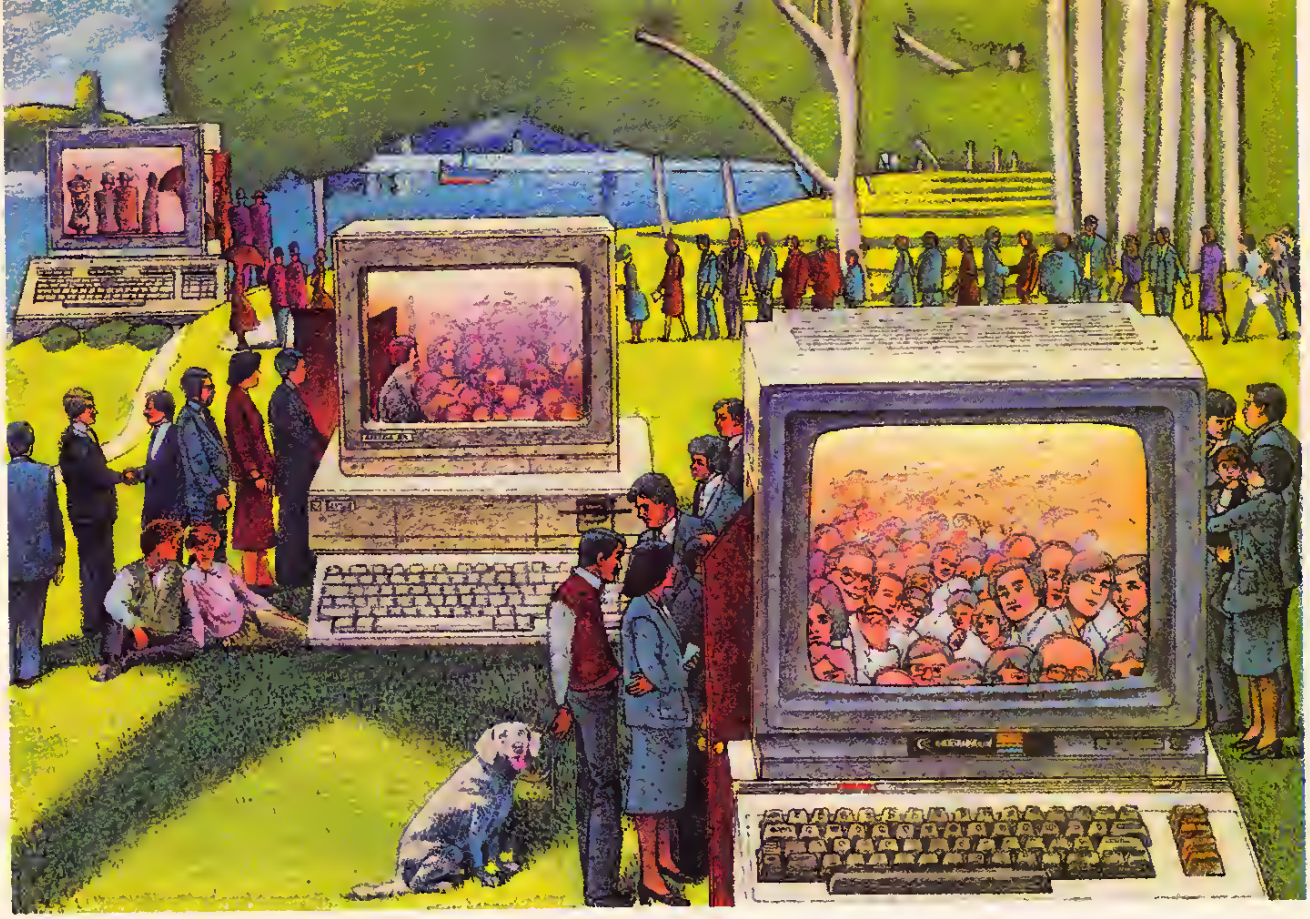
Numeric Keypad In 64 Mode

I have just acquired a Commodore 128. Since the numeric keypad does not work in 64 mode, I would like to know if you have any ideas of how to make it operable.

John Ballato

Here is a program that does what you want. It's taken from COMPUTE!'s 128 Programmer's Guide, *available from* COMPUTE! Books.

```
100 FOR AD=B30 TO 949:READ
    {SPACE}BY:CK=CK+BY
```



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```
110 POKE AD,8Y:NEXT
120 IF CK<>13099 THEN PRINT
     TAB(7)"{RVS} ERROR IN
    {SPACE}DATA STATEMENTS
    {SPACE}":STOP
130 SYS 830:PRINT"{2 DOWN}*
    * NUMERIC KEYPAD IS NOW
     ACTIVE **{2 DOWN}"
140 NEW
830 DATA 120,169,75,141,20,
    3,169,3,141,21
840 DATA 3,88,96,169,248,14
    1,47,208,169,255
850 DATA 141,0,220,205,1,22
    0,208,10,141,47
860 DATA 208,74,141,0,220,7
    6,49,234,160,0
870 DATA 140,141,2,169,251,
    141,47,208,162,8
880 DATA 173,1,220,205,1,22
    0,208,248,74,144
890 DATA 9,200,202,208,249,
    110,47,208,176,234
900 DATA 185,157,3,16,7,162
    ,1,142,141,2
910 DATA 41,127,133,203,169
    ,255,141,47,208,32
920 DATA 72,235,76,126,234,
    64,35,44,135,7
930 DATA 130,2,64,64,40,43,
    64,1,19,32
940 DATA 8,64,27,16,64,59,1
    1,24,56,64
```

Be sure to save the program before you run it, since it erases itself. The program mimics the computer's own keyscan routine to read the numeric keys and the new row of cursor keys. To activate the keypad, enter Commodore 64 mode, load the program, and run it. The numeric keypad keys now act exactly like the normal number keys (however, CTRL, SHIFT, and the Commodore key have no effect on them). RUN/STOP–RESTORE disconnects the program; enter SYS 830 to restart it.

Atari Unlist

I own an Atari 800 and have been trying to prevent people from LISTing my BASIC programs. Is it possible to do this?

John A. Butera

Ian Chadwick provides an interesting solution to this problem in his book Mapping the Atari, *available from* COMPUTE! Books. *First, save a copy of your original program (this is very important because the scrambled version of the program will be almost impossible to restore). Then add these two lines to the program, replacing FILENAME with the filename you wish the scrambled version to have.*

```
32000 FOR VARI=PEEK(130)+
      PEEK(131)*256 TO PE
      EK(132)+PEEK(133)*2
      56:POKE VARI,155:NE
      XT VARI
32100 POKE PEEK(138)+PEEK
      (139)*256+2,0:SAVE
      "D:FILENAME":NEW
```

Type CLR:GOTO 32000 in immediate mode and press RETURN. Line 32000 replaces all the program's variables with carriage returns and line 32100 saves the program to disk. This version of the program can't be LISTed or even LOADed. The only way to run it is with the command RUN "D:PROG" (substitute the name of your program for PROG).

Apple Renumber And Merge

I have been unable to find a renumber program and a merge program that can be used with my Apple IIc system. I would prefer typing the program rather than purchasing software. Any suggestions?

Robert Carney

COMPUTE! *has never published a renumbering program for the Apple. You may, however, come across such a program in the public domain or in another publication. Be forewarned, however, that renumbering programs sometimes contain obscure bugs that cause problems only in rare instances.*

One renumbering program that has *been thoroughly tested and debugged is* Applesoft Programmer's Assistant, *known as* APA. *This program adds several useful commands to BASIC and is available through your Apple dealer in DOS 3.3 as well as in ProDOS format. It includes both renumber and merge*

commands.

You can also merge programs without APA using the built-in BASIC command EXEC. Although it takes a little more work than APA's merge command, this technique is just as effective. For instance, suppose you wish to merge two programs named A and B. First, you must make sure the two programs do not share any line numbers. Otherwise, the program being merged will overwrite the corresponding lines of the program in memory. Thus, you may need to do some renumbering before you perform the merge.

After you have eliminated all shared line numbers, list program B to disk as a text file. This is done by putting the following lines at the beginning of program B:

```
6 PRINT CHR$ (4)"DPEN B.TEXT
  ": PRINT CHR$ (4)"WRITE B.T
  EXT"
7 LIST 100,32767
8 PRINT CHR$ (4)"CLDSE B.TEXT
  ": ENO
100 REM PRDGRAM B BEGINS HERE
```

Then, load program A into memory, type this line in immediate mode (without a line number), and press RETURN:

```
EXEC B.TEXT
```

The computer reads program B from disk, displaying each line as it is merged into memory. When this process ends, programs A and B are merged just as if you have added every line of program B manually.

IBM Custom Characters

The Commodore 64 character set can be customized by changing the contents of a particular memory location (which normally points to character data in ROM) to point to an area in RAM where your redefined characters are stored. Is it possible to customize the IBM PC character set, and if so, how?

Benito Franqui

Yes, you can redefine the character set on the IBM PC as well as on the PCjr. However, there are a couple of restrictions. First, on both machines, redefined characters must be printed on one of the graphics screens to be seen. Second, on the PC, only the upper half of the character set (characters numbered 128–255) can be changed. The following program shows how to redefine CHR$(128) as an alien shape. It runs on both the PC and PCjr, and displays the custom character on SCREEN 1.

```
10 OEF SEG=0
20 PDINTER=&H7C:REM For chara
   cters 0-127 on PCjr only,
   POINTER=&H110
30 FDR VECTDR=0 TO 3:DLDVEC(V
   ECTOR)=PEEK(POINTER+VECTOR
   ):NEXT:REM Save default po
   inters
40 DEF SEG=&H1700:REM Put cha
   racter data at &H1700
50 FDR DDTPOS=0 TD 7:READ DOT
   DATA:POKE DOTPOS,DOTDATA:N
   EXT
60 OEF SEG=0:REM Restore segm
   ent
70 SCREEN 1:CLS
80 FOR VECTDR=0 TO 2:PDKE (PD
   INTER+VECTOR),0:NEXT:POKE
   POINTER+3,&H17:REM Set cha
   racter data pointers to &H
   1700
90 PRINT CHR$(128)
100 FOR VECTDR=0 TO 3:PDKE (P
    OINTER+VECTOR),OLOVEC(VEC
    TOR):NEXT:REM Restore cha
    racter data pointers
110 DATA 60,126,90,126,60,36,
    66,129:REM alien shape
```

Just as with the 64, you make the computer look to RAM rather than ROM for its character data. If you have at least 128K of RAM in your PC or PCjr, memory above 96K is unused by BASIC and is thus a safe place to store the custom character data. Line 40 of the program accesses this area with the statement DEF SEG=&H1700. In line 50, the program puts the alien shape data in the area beginning at &H1700. Line 110 contains the data.

To make the PC/PCjr fetch its character data from the segment at &H1700, we must change certain pointers at the bottom of memory. These pointers are four bytes long. The first two bytes represent

an offset to the segment address contained in the third and fourth bytes. On both the PC and the PCjr, the pointer to data for the built-in graphics and foreign language characters (numbered 128–255) is at location &H7C. Since our program redefines a character in this range—CHR$(128)—we've used this pointer value in line 20. On the PCjr, you can redefine characters in the range 0–127 using the pointer at location &H110. In order to access either character data pointer, you must set DEF SEG to zero since the pointers are at the bottom of memory. The program does this in lines 10 and 60.

Before the program ends, the character data pointers must be restored to their default values. If you end the program with the character pointers still modified, the computer can't recognize the custom characters and will fail to respond to any commands (this is unlike the Commodore, which lets you use modified characters as usual, no matter what their shape). Before modifying the characters, save the default character set pointers (line 30). When you're done printing the custom characters, restore the pointers to their original values (line 100). You can find more information on this subject in COMPUTE!'s First Book of IBM, *written by Sheldon Leemon and available from* COMPUTE! Books.

Cleaner Atari INPUT

I am designing an adventure game with my ATARI 800XL. I would like to know if there is a way to get rid of the question mark prompt during INPUT.

Chris Genigeski

Instead of using INPUT in the standard way, open a file to the editor device (E:) and receive input from that file. Since a question mark is superfluous for file input/output, the computer suppresses it. This short program illustrates the technique. Line 20 opens a file to the editor and line 40 receives the input.

```
10 DIM A$(20)
20 OPEN #3,4,4,"E:"
30 PRINT "ENTER YOUR NAME
   "
40 INPUT #3,A$
50 PRINT A$
```

Standard RGB Monitor With ST?

Is there any way to hook up the Atari ST to a standard RGB monitor? If not, do you know of any products on the way from third-party vendors that will facilitate this? My Magnavox CM8562 monitor has an eight-pin DIN socket.

Don Kusch

To address your second question first, no such product is commercially available at the time of this writing (July, 1986). There are two major difficulties standing in the way of such an interface. The first problem has to do with hardware availability. The ST end of the video connector requires a nonstandard 13-pin plug which is next to impossible to find—even if you're a commercial cable manufacturer.

Second, in addition to sending out video signals, the ST's video port makes it possible for the computer to tell whether you're using a monochrome or color monitor. Pin 4 of the connector is the monochrome-detect line. When the voltage level on pin 4 is low, the computer automatically boots up in high-resolution monochrome mode. When pin 4 is set high, the computer boots up in color mode. The ST monitors pin 4 continuously. Whenever it detects a a voltage transition on pin 4 (for instance, if you unplug the video cable), the computer performs a cold start.

Assuming you can find or fabricate a usable 13-pin connector, you must also find some way to hold pin 4's voltage at the correct level. The video port doesn't provide a voltage source appropriate for this purpose, so you must obtain it elsewhere. Perhaps the safest source would be a commercial power supply. An experienced electronics technician might be able to tap a suitable source somewhere in your monitor's circuitry, but that sort of experimentation is best left to professionals. The power supply in a TV or monitor carries potentially fatal high-voltage current. Once you surmount the monochrome-detect problem, you may have other problems matching the ST's audio and video signals to the requirements of your particular monitor.

We've heard from one brave soul who succeeded in cobbling together a homebrew ST interface for his Sony KV-1311CR monitor. He obtained a 13-pin plug by the simple (but costly) expedient of buying a replacement video cable from Atari and chopping it in half. By the time he finished the project—which involved tapping into the Sony's internal circuitry—his investment ran close to $100, including the cost of the Atari cable. We've never seen the finished product, so the picture and sound quality on that system is unknown. Since it involves modifying the monitor itself, only a technician could tell you whether a similar solution is practical on your Magnavox monitor.

In short, it's possible to construct such an interface, but at this stage it's strictly a do-it-yourself project for the sophisticated hobbyist. As the ST becomes more popular, it seems inevitable that some enterprising manufacturer will market a video interface for non-Atari RGB monitors. If and when that product appears, it will probably cost more than a conventional cable, due to the need for extra circuitry. ©

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A gaggle of new games is on the way to your computer as software manufacturers gear up to take advantage of the new Atari ST, Amiga, and Macintosh machines. At the same time, gamemakers are creating some of the most advanced entertainment software yet designed for the Commodore 64, Apple II, IBM, and eight-bit Atari computers. The combination is making 1986 a great year for games.

Selby Bateman, Features Editor

"I don't think designers have worked very hard to push the Commodore 64 to its limits. It still hasn't been tapped to its fullest potential," says Alan Miller, a computer industry veteran and cofounder of Accolade, a computer game company.

Miller's comments reflect his view of the computer game market today, and they're being echoed by almost all of the leading developers of computer entertainment software. Comments from company presidents and product managers at the Summer Consumer Electronics Show and in conversations since then reveal a consistent pattern: They believe there is a strong future for both traditional eight-bit and new 68000-based computers.

Game companies have moved quickly to take advantage of the powerful graphics-and-sound capabilities found on the new 68000-generation computers—Amiga, Atari ST, and Macintosh. A variety of new games and conversions of popular eight-bit programs are being released this year and next. And that includes conversions of many popular eight-bit games. Although it's impossible to list all the conversions here, chances are that just about any successful eight-bit computer game is headed for Atari ST, Macintosh, and/or Amiga versions late this year or early next.

Many of the companies are hoping to take advantage of the huge installed base by announcing new entertainment products that push the Commodore 64, Apple II–series, and eight-bit Atari machines beyond what has previously appeared. And game companies that previously had little reason to have IBM PC versions of their products are now targeting IBM and IBM-compatible markets to take advantage of lower-priced MS-DOS computers—Tandy 1000, Leading Edge, and others—that are selling into the home market.

Here are just a few of the highlights of what's currently available and what will be out by the end of the year.

Games

Tass Times in Tonetown

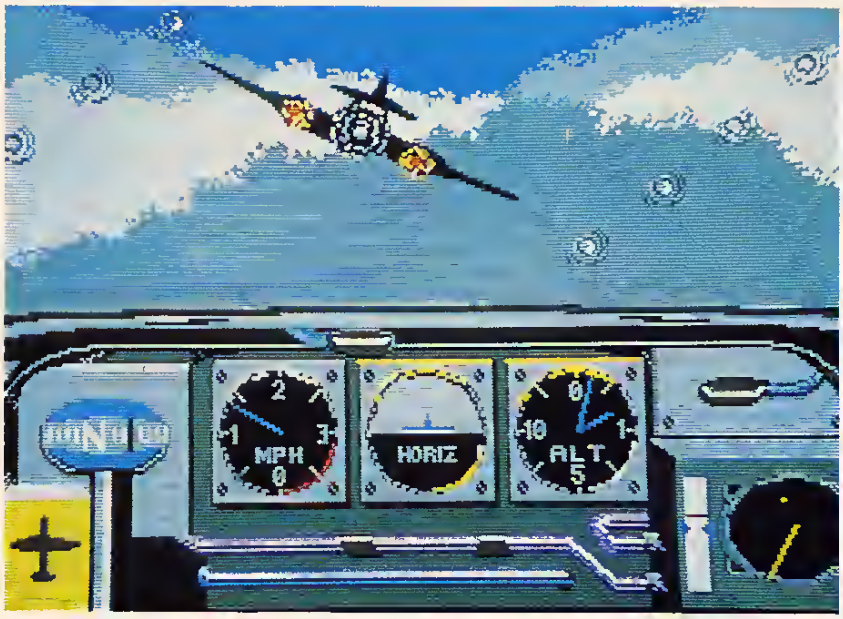
Superb color graphics in the Amiga version of Activision's unusual Tass Times in Tonetown *help make this a fascinating new game.*

The Movie Monster Game

As Godzilla, you're ready to tear up London town in Epyx' The Movie Monster Game *for Apple, Commodore, and IBM computers.*

Time Bandit

Michtron's Time Bandit *for the Atari ST provides level upon level of fast-action game play and detailed color graphics.*



Accolade's Ace of Aces *for the Commodore 64 puts you in the pilot's seat over war-torn World War II Europe.*

Ace Of Aces

Accolade

This World War II aerial-warfare game for the Commodore 64 features excellent color graphics and sound effects. You're in the pilot's seat, flying an RAF Mosquito over Europe in one of four different air battles. Each of the battles requires special weapons, battle, and navigation skills. To become an ace of aces, you have to successfully complete all four missions. There are five views from the cockpit, and you use them all to battle enemy fighters and bombers, V-1 rockets, German U-boats, and enemy supply trains.

Acro-Jet

MicroProse

This is an advanced flight simulator that takes up where the popular *Solo Flight* flight simulator stopped. It's a realistic simulation that's also fun to play. Up to four players can compete in ten acrobatic jet maneuvers, including precision rolls, loops, ribbon cuts, and other trick moves. As with other simulations from MicroProse, great emphasis is placed on attention to detail and realistic controls. *Acro-Jet* is currently available in a Commodore 64 format.

Arch-Mage's Tale (Bard's Tale II)

Electronic Arts

Following on the heels of the very successful fantasy role-playing game, *The Bard's Tale*, Electronic Arts is releasing a sequel in Commodore 64 format that's even bigger. The new storyline includes seven different cities—rather than one as in *Bard's Tale I*—and there are a host of new magic spells, bad guys, and a new character class.

Battlefront

Strategic Studies Group/Electronic Arts

This entry is from the same development group that produced *Reach for the Stars, Europe Ablaze*, and other popular strategy games. *Battlefront* is a recreation of land battles from World War II, and includes four separate scenarios and a design kit. You take the role of a corps commander, issuing orders to divisional and regimental headquarters in the battles of Crete, Stalingrad, Saipan, and Bastogne. The game will be available for the Commodore 64 and Apple II-series computers.

Breakers

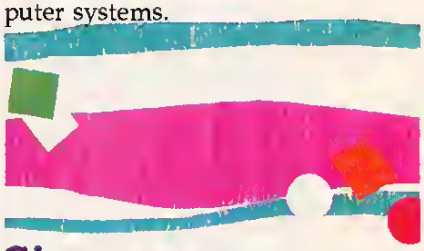
Brøderbund

A new science fiction text adventure, *Breakers* contains a 1500-word vocabulary that lets you communicate with the program in natural sentences. The adventure is set in a realtime environment; that is, time passes in the game even when you're idle. Characters move about, actions occur, and you've got to keep going just to keep from falling behind.

Chessmaster 2000

Software Country/ Electronic Arts

This is a very powerful chess competition program with both two-dimensional and three-dimensional playing boards and a very large library of opening moves. There are 12 different skill levels, plus a mode for learning how to play and a mode for replaying classic games from the past. This program will be available for all major personal computer systems.



Cinemaware

Cinemaware/Mindscape

This new series of interactive graphic adventures for the Atari ST, Amiga, and Macintosh includes many of the conventions of motion pictures—pans, tilts, close-ups, reverse angles, and 3-D turns. It's intended as a new concept of computer software that combines constant action with the latest in personal computer graphics. An elaborate debut is planned for the fall. Initial titles in the series are *Defender of the Crown, The King of Chicago, Sinbad and the Throne of the Falcon,* and *S.D.I.*, ranging from the days of chivalry to the Strategic Defense Initiative.

America's Bestselling Naval Simulation!

Captain's Log... War Date 10.01.44

"Captain's Log, October 1, 1944 0250 Hours. Fleet submarine USS Hammerhead proceeding Southwest at cruising speed. Our mission: Intercept enemy convoy off the coast of Borneo. Disperse and destroy."

"0300 Hours. Two hours until dawn. Radar picks up convoy, escorted by two destroyers. We believe that one of the enemy's valuable cargo ships is part of convoy formation."

"0400 Hours. Lookouts on the bridge. Target identification party reports one cargo ship, 4,000 tons, troopship of 10,250 tons, with two *Kaibokan*-type escorts. Moving into attack position."

Tandy 1000/IBM PC Jr screens shown

"0500 Hours Sound General Quarters! Battle stations manned. Preparing for torpedo run. Gauge Panel OK Periscope OK. Charts and Attack Plot Board OK. All mechanical systems OK."

"0525 Hours. Torpedo rooms report full tubes forward and aft Battery at full charge for silent running. We hope water temperature will provide thermal barrier to confuse enemy sonar."

"0600 Hours. We are at final attack position. Convoy moving at 10 knots Target distance decreasing rapidly... Crash Dive! Escorts have spotted us and are turning to attack! Rig to run silent."

"0700 Hours. Depth charged for one hour Some minor damage, but repair parties at work. Destroyer propeller noises receding. We'll come to periscope depth for our return punch."

"0715 Hours Torpedo tubes 1, 2, 3 fired. Two destroyers hit and sinking. One of the enemy's last cargo ships coming into 'scope view — an ideal target position. On my mark... Fire Tube 4! Fire 5!"

"Superb" roves Scott Moy in *On Line*, "strategic intensity and heart-pounding action have rarely been merged this successfully." *Analog* calls it flatly "the best submarine simulation so far." *Compute* comments "Silent Service's detail is astonishing." Join the more than 150,000 computer skippers who have volunteered for **Silent Service**, the naval action/tactics simulation — from MicroProse.

Silent Service is available for Commodore 64™/128™, Amiga™, Apple II family, Atari XL/XE, Atari ST, IBM PC/PCJr, and Tandy 1000, at a suggested retail price of $34.95 (Atari ST and Amiga, $39.95)

Available from your local retailer. If out-of-stock, contact MicroProse directly for further information on our full range of simulation software, and to place Mastercard/Visa orders.

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Conflict In Vietnam

MicroProse

The crucial battles of the Vietnam War are yours to study and replay in this strategy game. From the siege at Dien Bien Phu to the South Vietnamese defeat at Quang Tri, the battles pit North Vietnamese and Viet Cong guerilla tactics against French and, later, American conventional forces using advanced weaponry. There are five different scenarios in the program. Versions are available for Commodore 64, Apple II, IBM, and eight-bit Atari computers.

The Coveted Mirror

Polarware/Penguin

You are the main character in this graphics-and-text adventure, searching the kingdom of Starbury for the four missing shards of the magical Coveted Mirror that will free the land from the evil rule of King Voar. The game has a working vocabulary of more than a thousand words, and includes over 100 color-graphics screens. The parser, the part of the game that interprets your commands, lets you use full- and multiple-sentence instructions. Versions are available for all major computer systems.

Deceptor

Accolade

You're in charge of a robotic vehicle that can change from a ground-based rover to an airborne ship and eventually to a human shape. You'll need the changes to maneuver through six levels of mazes. *Deceptor,* for the Commodore 64, is a fast-action game that can be customized to your own level of responses. You can also practice different levels independently in order to help you reach the final confrontation.

Destroyer Escort

MicroProse

This new simulation for the Commodore 64, Apple II, and IBM computers is a historically accurate recreation of convoy escort duties in the North Atlantic during World War II. You're in command of either a fast, heavily armed destroyer or a more lightly equipped corvette vessel as you protect a convoy against German submarines and surface vessels. Accurate details for ship speeds, weapons, damage assessments, and tactics contribute to the game's realism.

Diablo

Classic Image

Diablo is an Atari ST game consisting of tracks, panels, and a ball in a maze. The program is an interesting combination of strategy and action, and is difficult to compare to other games. The sound and color graphics are excellent, and game play requires quick thinking, some dexterity, and planning.

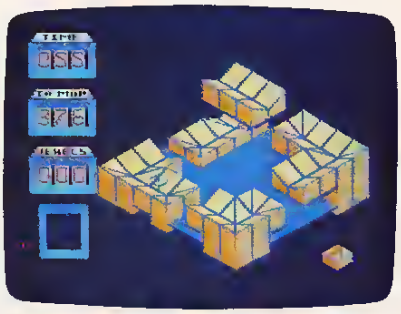
Electric Dreams Series

Activision

This is a brand new series of computer games, all of which have been top sellers in Great Britain. The first three programs in this series will be available for the Commodore 64 and Apple II–series:

The Rocky Horror Picture Show—The popular cult-classic movie has spawned a computer game, complete with the same characters from the movie. You play Brad or Janet, trying to unfreeze your partner by finding parts of a Medusa machine hidden somewhere by Dr. Franknfurter. You run into the same crew of zany characters from the movie as you go about your task.

Spindizzy—An action arcade-style game, *Spindizzy* is set on a distant planet. Your objective is to map out an unknown world, which you do by successfully navigating 386 different screens. The program features a special 3-D look and feel. You build your map with each completed screen.



With each screen you conquer, you're mapping an unknown world in the 3D science-fiction arcade game, Spindizzy, *from Activision for Commodore and Apple computers.*

Zoids— This is a takeoff of the popular Tomy characters you may have seen in toy stores and on television. On the planet Zoids, you control a blue zoidzilla. But, your zoidzilla has been taken apart and scattered around the planet. Now, you need to piece together your zoid to battle the ultimate zoid while fighting against a variety of lesser zoids. This, too, is an action adventure game.

Fairlight

Mindscape

This 3-D graphics adventure game for the Commodore 64 takes place in the mythical land of Fairlight. Once beautiful and radiant, the land is now blighted. And it's up to you to restore the magic.

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Gettysburg: The Turning Point

Strategic Simulations Inc.

SSI's Civil War strategy game, *Battle of Antietam*, was an immediate success earlier this year. *Gettysburg: The Turning Point*, from the same development group, promises to have even more depth of play. As with *Antietam*, the new game has three levels—Basic, Intermediate, and Advanced—and includes such factors as geography, war munitions, morale of the soldiers, and other realistic factors. Battle settings and maps are also historically accurate. The game is available for the Apple II-series, Commodore 64, eight-bit Atari, and IBM PC computers.

Gunship

MicroProse

This long-awaited helicopter simulation was delayed last year in order to make it as accurate and realistic as possible. Available first for the Commodore 64, an Apple version will be released late this fall, with IBM, Atari ST, and Amiga versions in early 1987. You're in command of an AH-64A Apache, the U.S. Army's most advanced attack helicopter. Advanced weaponry includes laser missiles, automatic cannon, rocket pods, zoom television gunsights, laser rangefinders, plus defensive detectors, jammers, and decoys. This promises to be one of the most rigorously detailed simulations yet from MicroProse.

This is the cockpit view in the realistic attack-helicopter simulation, Gunship, *from MicroProse, for the Commodore 64. Other versions will follow.*

Hacker II: The Doomsday Papers

Activision

The popularity of the original *Hacker* computer game from Activision made the idea of a sequel too good to pass up. This new game is more complex and challenging than the first, but the emphasis is still on having fun as you try to break the security of a major computer system and then save the U.S. from destruction. You get a few more preliminary instructions than with the original, and more depth of play as well. Versions are available for all major personal computers.

Leader Board

Access

This is a realistic golf simulation game for the Atari ST that features multiple 18-hole golf courses, 3-D animation, trees, sandtraps, and three levels of play. There's also computerized scoring and handicapping. The player makes decisions concerning club selection, distance, and other variables.

Marauder, Street Surfer, and S.W.A.T.

Mastertronic

These three games are the latest in a list of well over a dozen fast-action, budget entertainment programs from Mastertronic for the Commodore 64 and Atari eight-bit computers. Most all of these game programs are approximately $10. Atari ST and IBM versions of many of the titles are also planned this fall.

Marble Madness

Electronic Arts

This is a captivating Amiga program that takes full advantage of the machine's graphics and sound. The screen images are arcade-quality, and include excellent 3-D graphics. Game play is identical to the arcade version of this popular game as well. One player can race his marble through the mazes, or two players can compete head-to-head. There are six different playfield raceways. There's even a stereo music soundtrack.

Moonmist

Infocom/Activision

This is an introductory-level all-text adventure that puts you, an amateur sleuth, in the gothic Tresyllian Castle located in Cornwall, England. Is there really a ghost that walks the castle? And what is the treasure that all of the eccentric inhabitants of the castle seem to be searching for? *Moonmist* has four different variations, all on the same disk. Each variation has its own puzzles, treasures, hiding places, and solution to the mystery. There are versions for all major personal computer systems.

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Your tee-shot is headed down the middle of the fairway in the Atari ST version of Accolade's Mean 18 *golf game.*

Mean 18

Accolade

Mean 18 is a one-to-four-player golf simulation game for the Atari ST and IBM PC computers, complete with sand traps, water hazards, trees, and a total of 72 different holes. Full-color scrolling graphics make the game visually engaging as you play on one of three famous courses. There's also a Course Architect that lets you build or modify your own golf courses.

The Movie Monster Game

Epyx

Become Godzilla or one of your favorite movie monsters and lay waste to a city, defeating the army, navy, and air force at the same time. As you tromp around various urban landscapes, you have all of the typical monster attributes—toxic breath, loud screams, and, of course, big feet. *The Movie Monster Game* features colorful graphics and plenty of action. The game will be available first in Commodore 64, Apple II, and IBM computer versions.

Murder Party

Electronic Arts

This game lets you host your own murder parties, with up to seven people. The computer generates all the materials you need, such as invitations, roleplaying instructions, and clues. The culprits and the clues are variable from game to game. There will be Commodore 64 and Apple II versions of the game this fall.

Ogre

Origin Systems/Electronic Arts

Origin Systems has introduced an Apple II version of the popular strategy board game, Ogre. As in the original, a solo-fighting Cybertank battles a conventional force of infantry, armored units, and command posts. One player can take either side against the computer, or two players can challenge each other. There are ten different playing fields to choose from, and the game features full-color graphics on the Apple II.

Pure-Stat Baseball

subLogic

This baseball simulation contains extensive statistical features, and should appeal to baseball fans who like their simulations as realistic as possible. One or two players can take part, managing any team from the 1985 pro season and eight classic teams from the past. Included is a feature that lets you create your own players or draft them. Three stadiums are included on the disk, and there's an optional stadium disk that contains all the major league stadiums in the U.S. You have control over just about every variable, and the program maintains a complete statistical record of every team and every player. These stats can be printed out as well as viewed onscreen. Available first for the Commodore 64; other versions will follow.

Scavenger Hunt

Electronic Arts

Ozark Softscape, the developers who created the successful games of *MULE*, *Seven Cities of Gold*, and *Heart of Africa*, are now offering a program that's half computer game and half board game. *Scavenger Hunt* is for up to four players, who use animated robots to seek out bizarre items in the quest to win. Commodore 64 and Apple II versions are available.

The Scoop

Telarium/Spinnaker

Spinnaker has expanded its Telarium line of graphics-and-text adventures with *The Scoop*, based on an Agatha Christie story. In this new software adaptation, you take the role of a London reporter trying to solve a mysterious series of murders for his paper, *The Daily Courier*. You must find clues, talk to witnesses, eavesdrop on other people's conversations, and get the scoop on the murders. *The Scoop* is available for Apple II–series (128K) and Commodore 128 computers.

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Shanghai

Activision

This is a new computer puzzle game based on the ancient oriental game of Mah-jongg. The initially released version is for the Macintosh, with MS-DOS and Apple II versions planned for release by the time you read this. There are 144 tiles in the game, consisting of seven visually different suits stacked in a five-level dragon-shaped pyramid. You must remove them in pairs, and each game is different. This is a classic game of strategy, memory, and luck. There are solitaire, multi-layer tournament, and head-to-head clock matches contained in the program.

Spitfire 40

Avalon Hill

This entertainment package is both a flight simulator and a World War II airwar combat program, planned initially for the Commodore 64. Other versions are to follow. You're at the controls of the Mark I Supermarine Spitfire, watching the dials, gauges, and compass, and trying to keep the fuel pump operating as you go into a dive. You can save your flight log to disk, recording kills and missions flown. Versions are available for Commodore 64, Apple II, Atari, and IBM computers.

Spy Vs. Spy III: Arctic Antics

First Star

The two previous adventures in this series, *Spy Vs. Spy* and *Spy Vs. Spy II: The Island Caper*, brought players a successful combination of excellent color graphics and ingenious game play. The nonstop battle between *MAD Magazine*'s ingenious spies continues with this sequel set in the frozen northland. Versions are available for the Commodore 64, Apple II-series, and Atari eight-bit computers.

Starglider

Firebird

This Atari ST space-combat action game promises to take full advantage of the ST's speed and color graphics. Using animated 3-D vector graphics, you have a first-person perspective while piloting your attack vehicle against an alien armada. The game features air-to-air and air-to-ground combat simulations. *Starglider* also uses digitized sound and requires you to develop your piloting skills to succeed. Commodore 64 and Apple II versions will soon be available as well.

Colorful 3D vector graphics are a part of Firebird's new Starglider *space action game for the Atari ST.*

subLogic Scenery Disks

subLogic

Two new flight simulator scenery disks, for use with *Microsoft Flight Simulator*, *Flight Simulator II*, and *Jet*, have been added to the list by subLogic. These new programs include a San Francisco/Bay Area route that offers views of prominent buildings on Fisherman's Wharf, Alcatraz Island, and the Golden Gate Bridge, among other sights; and a Japan route that details the area from Tokyo to Osaka, with a rendition of downtown Tokyo, Mt. Fuji, and many other sights. The disks are available in Commodore 64, Atari eight-bit, and IBM PC formats.

Tass Times In Tonetown

Activision

This illustrated text adventure is a bizarre trip through an alternate reality. You can't get into Tonetown unless you're *tass* (an up-to-the-minute variation of *cool*). You're in search of Gramps, and you end up in a dream world aided by a dog reporter, and...need we say more? This promises to be one of the more offbeat entries from a company that has produced a variety of other innovative programs, such as the very popular *Little Computer People*. *Tass Times In Tonetown* will be available for all major personal computer systems.

10th Frame

Access

This is a Commodore 64 bowling simulation game from the same company that developed the popular *Leader Board* golf simulation for the Commodore. As in *Leader Board*, *10th Frame* features full-color graphics and attention to the details of game play.

Thomas M. Disch's Amnesia

Electronic Arts

This is the first all-text adventure game from Electronic Arts, and they've used the expertise of award-winning science fiction author Thomas M. Disch to make it a good one. The plot reads like your worst nightmare: A strange woman wants to marry you, someone wants to kill you, the state of Texas wants you for murder, and you don't know who you are. The game covers more than 4000 locations in Manhattan, including the entire subway system. The game is available in Commodore 64, Apple II, and IBM versions.

Time Bandit

Michtron

This is one of several new Atari ST entertainment programs from Michtron, and it's an excellent action game with great depth of play. There are 16 different arcade levels within 16 lands you'll explore—more than 3,000 screens in all. Three adventure games are a part of the arcade levels, also. The detailed color graphics smoothly scroll in all directions, and a special two-player twin-screen mode gives *Time Bandit* even more playability.

The Toy Shop

Brøderbund

Build your own mechanical toys, customizing them in a variety of different ways, with this innovative new package from Brøderbund. There are 20 different toys that you put together. They're fully operational, and all of the material you need to build them comes with the kit. *The Toy Shop* is available for the Commodore 64 and Apple II computers.

Trinity

Infocom/Activision

Magic and hard science coexist in the alternate universe of *Trinity*. The game plunges you into the middle of an exploration across time and space as you try to reshape history. The climax of the game, if you make it that far, occurs at the dawn of the atomic age just as the first atomic blast is to occur in the New Mexico desert—project Trinity. This is a new all-text adventure from the highly respected Infocom group, and is aimed at a standard level of play. Versions are available for all major personal computer systems.

Uninvited

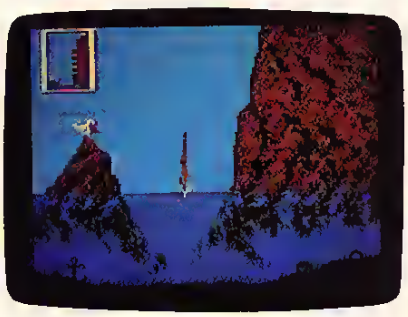
Mindscape

In the midst of a gothic mansion, with demons and gremlins stalking your every move, you try to overcome the black magic that has overtaken the place in this graphics-and-text adventure for the Macintosh. The game features sophisticated animation and digitized sound, as well as a complex plot.

World Games

Epyx

The popularity of Epyx's *Summer Games*, *Summer Games II*, and *Winter Games*, has led to the release of *World Games*, which features eight new athletic events set in different countries around the world. As with the earlier games in this series, the color graphics are excellent and the game play is varied and action-oriented. This will be available for all major personal computer systems.



Cliff-diving is one of eight athletic contests in Epyx' new World Games, *available for most personal computers.*

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Habitat

A Look At The Future Of Online Games

Kathy Yakal, Assistant Features Editor

Online gaming, or telegaming, *has for years been a feature of many bulletin board systems (BBSs) and computerized news and information services. Ranging from versions of simple board games like checkers to the complex world of CompuServe's* MegaWars, *the offerings from this electronic service give players the opportunity to compete with opponents across the country. Recently, QuantumLink and LucasFilm Games announced a new online feature for Commodore 64 owners:* Habitat—*a unique, animated game that encourages interaction, not competition, among users.*

Electronic interaction—the online, realtime socializing done in conference areas of BBSs and online news and information services—is one of the most popular consumer applications for telecommunications today. Though many home computer owners use their modems for doing job-related work, downloading programs, doing research, and trading technical information, many prefer to use them for play. People make new friends online, often extending those relationships into written correspondence, telephone calls, and face-to-face meetings.

For example, CB'ers on CompuServe, a major telecommunications service, hold regular conventions, arriving at a central location from all over the country to see the faces behind the "handles" they use on the system. Some electronic correspondents have even developed online relationships that have led to marriage.

Online relationships are dependent on the common threads that people find and follow in their conversations. People may discover that they once lived in the same city, or like the same obscure movies or books, or have similar jobs. When they meet again online, they recognize each other, and have a common starting ground for conversation.

Telegaming is a more focused way of interacting with people online. There's no fumbling around, trying to find something to talk about. You're there to participate in a game. For some people, that's interaction enough. But some go further, moving into conference areas to talk about the game they've just played, and to see what other interests they share.

Habitat is an intriguing combination of telegaming and straight online chatting. It's an outgrowth of QuantumLink's People Connec-

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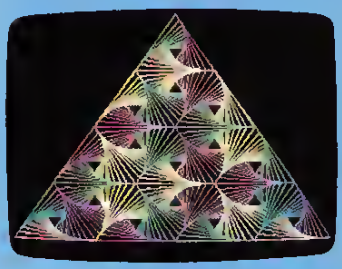

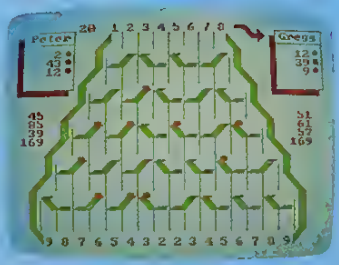

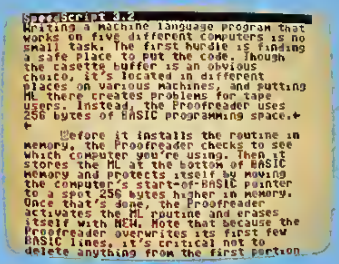

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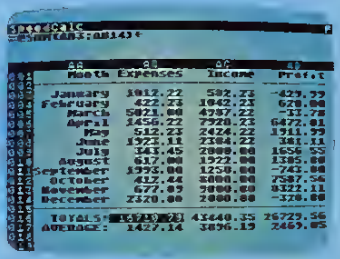

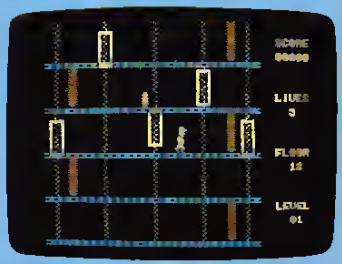

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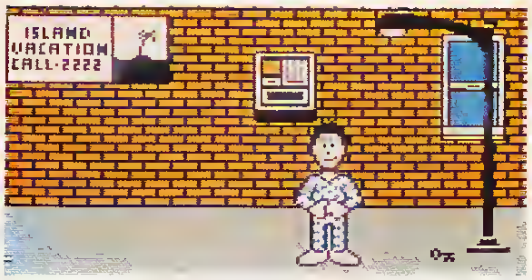

tion, the service's online chat area. Instead of communicating through words alone, you create a character to represent yourself, and move around through the many "rooms" in *Habitat*, meeting other characters and joining them on adventures. *Habitat*, unique to this point in the history of computer entertainment, is an early version of the kind of entertainment often predicted by industry futurists: the interactive motion picture.

Colorful And Key-Controlled

Since its introduction a year ago, QuantumLink has attracted thousands of subscribers in the Commodore community. QuantumLink (Q-Link) is an online news and information service with a slightly different focus from that of other services. It was designed to be an event-oriented system solely for Commodore 64 users—a gathering place for people with common interests that go beyond technical concerns. To fulfill that, sysops (system operators) and guest speakers with widely varied backgrounds have been enlisted to host special events and be available online to interact with users.

The Q-Link system is menu-driven, and all commands are issued using only the function keys. The service contains many of the elements we've grown accustomed to seeing in online services and major BBSs: electronic mail, online shopping, message boards, downloadable software and software previews, and online conferencing.

Since the system uses color and graphics, it's necessarily limited to owners of one specific machine—the Commodore 64—and was designed to take advantage of that computer's color and graphics capabilities. So it can't be accessed from a normal terminal program; subscribers must obtain a special Q-Link disk.

But that same limitation is exactly what gives *Habitat* broader possibilities. While other online services must keep their graphics generic and simple enough to be understood by the variety of microcomputers connecting to it, Q-Link's use of color and graphics is limited only by the boundaries of the Commodore 64.

An Imaginary World

Just as motion pictures use celluloid strips to create worlds that exist only while someone is watching them, *Habitat* depends on a mainframe computer to create a world that exists only while users participate in the game. Instead of sitting together in a theater somewhere watching the film, participants are seated at home computer terminals all across the country. And unlike movies, *Habitat* offers interactive, not passive, entertainment.

This online world that LucasFilm created has a rich environment all its own. According to its fictional storyline, *Habitat* is populated by Avatars, people who were great adventurers in earlier days. But left to themselves, Avatars are a gentle, lazy bunch—happy to sit around all day and read books or eat junk food. The Oracle, who reigns over the world, is hopeful that by his giving Q-Link subscribers access to

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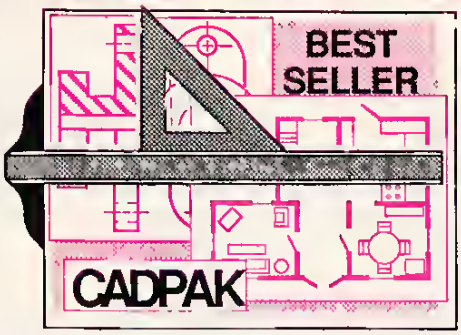

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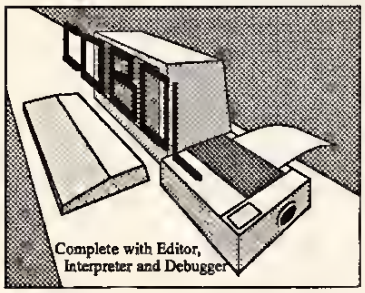

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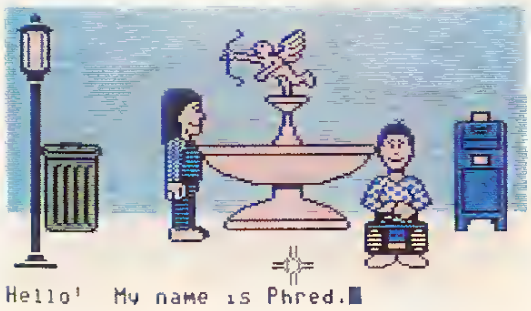

this world, the Avatars will once again become the interesting bunch they once were.

Once you've entered the world of *Habitat*, your first task is to create a character to represent yourself. This is done with a kind of character construction set. You decide what you want to look like and how you want your "turf" (home base) to be decorated. If you'd like, you can even have a pet. Then it's off to meet the other inhabitants of the world.

Your Avatar is controlled by commands entered via the joystick. You can Go, Do, Get, and Put—and, of course, Talk to other Avatars. The first four commands are used for moving from room to room and manipulating objects you find there.

Communication with other Avatars can be accomplished by letter, by phone, or just by talking directly to them, if you're in the same room. It's similar to the three ways in which you normally communicate with another user on Q-Link: E-Mail, online messages, or joining a conference in the People Connection area. Unlike People Connection—where your words appear next to your name after you've typed them and pressed RETURN—*Habitat* shows your words in a little bubble above your character's head, as in a cartoon.

If at any point you get lost in this world, there is help available. You can look at maps or visit the Hall of Records. And the Oracle is always around for guidance.

Some DOs And DON'Ts

In the course of your adventures in *Habitat*, you'll discover some cultural norms, just as in the real world.

DO

- Make new friends.
- Buy things, using tokens or credit cards.
- TelePort (transport yourself to other rooms too far to walk to).
- Hang out at the Oracle, *the* place to see and be seen. In Avatar slang, you *head down to the O.*
- Make phone calls.
- Go on adventures.
- Explore.

DON'T

- Participate in organized sports. Avatars just want to have fun, and don't like having someone tell them how to do it.
- Play cards (for the same reasons listed above).
- Watch television. Enough said.
- Drive vehicles. Walking and teleporting are the preferred modes of transportation, unless you happen upon a skateboard.
- Be materialistic. You're an Avatar, not a Yuppie.
- Overextend your Avatar's hospitality. Only six people to a room at any one time.

With computers in more than 10 percent of American homes, entertainment developers can afford to try different things, hoping to capture the interest of even a small percentage of them.

Which segment of the home computing population *Habitat* appeals to remains to be seen. There's certainly room for it: Traditionally, telegaming has had a rather limited audience, though its small following is devoted. *Habitat* is an innovative new addition to the growing world of online gaming.

The monthly fee for QuantumLink is $9.95 for unlimited use, with a $3.60 charge for some special services. At this writing, the hourly charge for Habitat *has not been determined. For more information, write to Quantum Computer Services, 8620 Westwood Center Dr., Vienna, VA 22180; or call (800)392-8200.* ©

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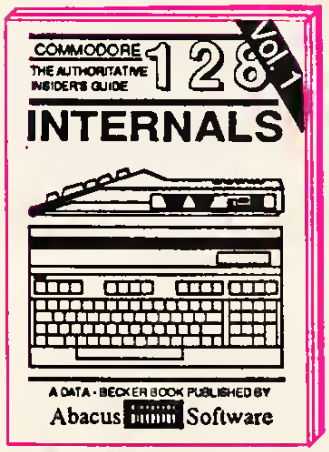

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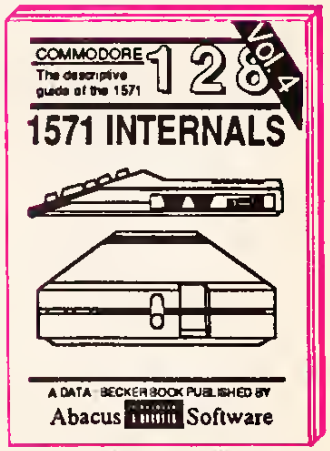

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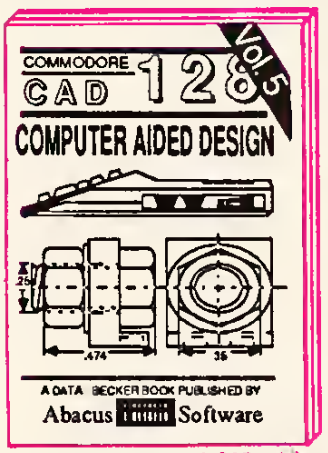

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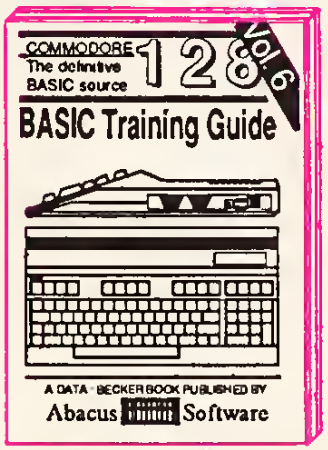

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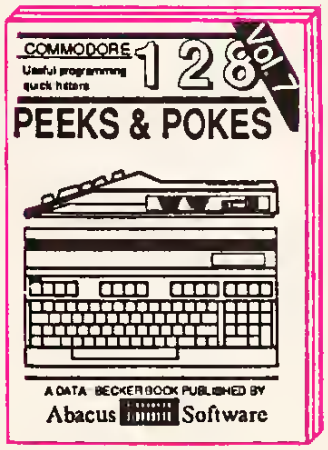

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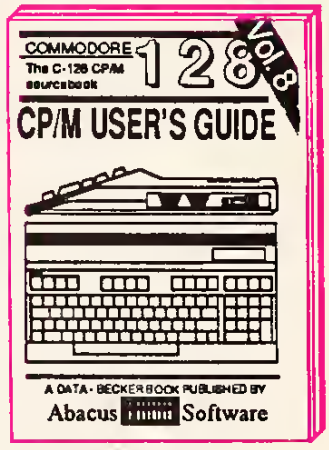

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Prisonball

John Scarborough

Nearly everyone has played Pong *or* Breakout, *two computer-game classics. "Prisonball" creates an intense, two-player action game by drawing features from both of those games. The original version runs on any Atari 400, 800, XL, and XE computer with at least 48K memory. Atari Prisonball also requires a set of game paddles. The Commodore 64 version requires either a pair of paddles or two joysticks. The Apple II version runs under DOS 3.3 or ProDOS, and requires a set of Apple paddles.*

"Prisonball" is a two-player action game that combines the best elements from two classic computer games, *Pong* and *Breakout*. The object of the game is simple—knock out as many bricks as you can in the allotted time. Type in Prisonball from the listing for your computer; then save a copy of the program before you try to run it. Every version of the game is similar, so be sure to read the general game rules before referring to the specific notes for your computer.

Break To The Center

The game begins by displaying five colored walls running vertically down the center of the screen. Each player controls two paddles located at the left and right sides of the screen. Three balls appear at a random location and start bouncing around the screen. When a ball is on your side of the screen, move one of your paddles into its path to deflect the ball toward the walls. You can only hit a ball when it's moving toward your paddles (away from the interior walls). Balls travelling from the opposite direction go right through your paddles. If you happen to miss a ball, it wraps around the screen and appears on the other side, giving your opponent a chance to score.

At the beginning of the game, all three balls are a neutral color. Each time you hit a ball, it changes to the color of your paddle. You score whenever a ball of your color hits one of the five interior walls. The score depends on which wall you hit. The center wall is the hardest to reach, so it yields the most points. The two intermediate walls are worth less than the center wall. The outermost walls are easiest to hit and score the fewest points.

The top of the screen displays each player's score and a countdown timer. When the timer runs to zero, the game ends and the player with the most points wins.

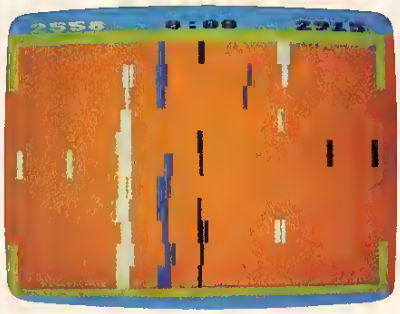
Every time a ball hits one of the walls, a brick is knocked out of the wall at the point of impact. By aiming your shots carefully, you can bore a path through a wall and move a ball into the interior space between two walls. When this happens, the ball bounces wildly back and forth between the walls, scoring many points in a short time.

An additional bit of strategy has to do with the redrawing of walls. Whenever a wall has been destroyed, it is immediately redrawn. Some of the highest scores result when you trap one or more balls behind a wall when it is redrawn. Since the wall is new, the trapped balls may hit it many times before they break back out to the exterior.

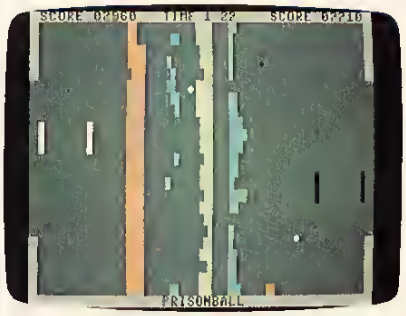
Atari Version

Atari Prisonball runs on any eight-bit Atari computer (not on an ST) with at least 48K memory. Game paddles are required. Although the game is written in machine language, it is listed in the form of a BASIC loader which you can type as you would any BASIC program. Be sure to save the program before you run it.

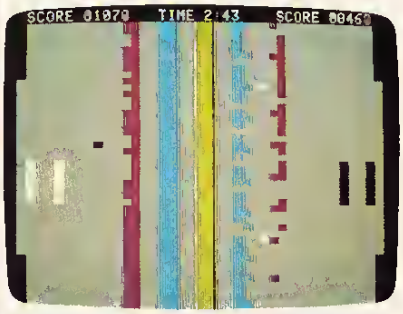
To play Atari Prisonball, plug a pair of paddles into port 1, run the program, and press START. When both players are ready, press either paddle button to start the game. You score ten points for each brick from the center wall, five points for bricks from the two adjacent walls, and one point for bricks from the two outside walls. Each game lasts five minutes. The winner is the player with the highest score at the end of the elapsed time.



Atari version.



Commodore 64 version.



Apple II version.

Commodore 64 Version

The 64 version of Prisonball is written completely in machine language and must be typed in with the "MLX" machine language entry program found elsewhere in this issue. Read the MLX instructions carefully before you start to type the program. When you run MLX, you'll be asked for a starting address and an ending address for the data you'll be entering. Here are the starting and ending addresses required for Prisonball:

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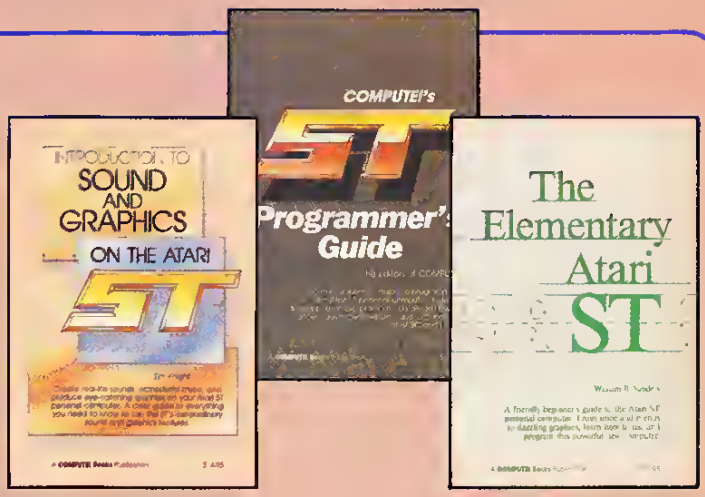

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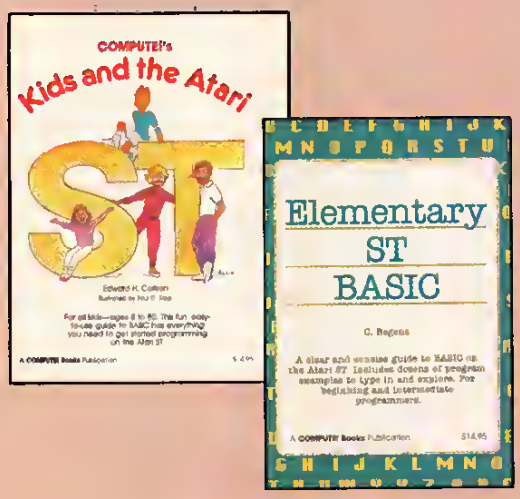

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Starting Address: 0801
Ending Address: 0F90

Either joysticks or paddles can be used to play this game. To play with paddles, plug a pair of paddles into port 2. Even though the program is written in machine language, you should load and run it like an ordinary BASIC program. In this version of Prisonball, each game lasts for three minutes. The screen border flashes briefly as a warning when only 20 seconds remain on the timer. Bricks from the center wall are worth 30 points, those from the two adjacent walls are worth 20, and the outermost bricks each score 10 points.

Apple II Version

Apple Prisonball runs on Apple II–series computers with either DOS 3.3 or ProDOS. The program must be entered using the "Apple MLX" machine language entry program published elsewhere in this issue. Be sure that you understand the instructions for using Apple MLX before you begin to type in Apple Prisonball. Here are the MLX starting and ending addresses for the game:

Starting address: 1000
Ending address: 1647

After you've entered the game and saved a copy, start Prisonball with a BRUN command. For instance, if you saved the game with the filename GAME, enter BRUN GAME and press RETURN. Prisonball is played with paddles and each game lasts three minutes. If the action becomes too hectic, press any key to pause the game. The scoring is identical to that used in the Commodore 64 version. If you wish to quit the game and exit to BASIC, press CTRL-C.

The Apple II version of Prisonball uses a special technique to put a text window at the top of the lores screen. You may need to remove the parallel printer interface from your computer in order to make this work.

Program 1: Prisonball for Atari 400, 800, XL, and XE

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
NC 8 ? "{CLEAR}ONE MINUTE, P
   LEASE"
FK 10 PAGE=PEEK(106)-32
ND 20 BASE=PAGE*256:CK=0
OE 30 FOR MEMLOC=BASE TO BAS
   E+471
NC 40 READ DATA:CK=CK+DATA
JN 50 POKE MEMLDC,DATA
GC 60 NEXT MEMLDC
KK 65 IF CK<>58440 THEN ? "D
   ATA ERROR IN LINES 100
   0-1660":STDP
FO 70 PAGE=PEEK(106)-30
NJ 80 BASE=PAGE*256:CK=0
LL 90 FOR MEMLOC=BASE TO BAS
   E+76
JP 100 READ DATA:CK=CK+DATA
ME 110 POKE MEMLDC,DATA
IP 120 NEXT MEMLDC
LA 125 IF CK<>9981 THEN ? "D
   ATA ERRDR IN LINES 17
   00-1800":STOP
JD 130 PAGE=PEEK(106)-29
AG 140 BASE=PAGE*256:CK=0
BI 150 FOR MEMLDC=BASE TO BA
   SE+175
KF 160 READ DATA:CK=CK+DATA
MK 170 POKE MEMLDC,DATA
JF 180 NEXT MEMLDC
OD 185 IF CK<>19695 THEN ? "
   DATA ERRDR IN LINES 2
   000-2250":STDP
JI 190 PAGE=PEEK(106)-28
AD 200 BASE=PAGE*256:CK=0
BO 210 FOR MEMLOC=BASE TO BA
   SE+949
KC 220 READ DATA:CK=CK+DATA
MH 230 POKE MEMLDC,DATA
JC 240 NEXT MEMLDC
OF 245 IF CK<>95830 THEN ? "
   DATA ERROR IN LINES 2
   400-3750":STOP
JB 250 PAGE=PEEK(106)-24
AJ 260 BASE=PAGE*256:CK=0
BL 270 FOR MEMLOC=BASE TO BA
   SE+346
KI 280 READ DATA:CK=CK+DATA
MN 290 POKE MEMLOC,DATA
IP 300 NEXT MEMLOC
OA 305 IF CK<>36545 THEN ? "
   DATA ERROR IN LINES 4
   000-4490":STOP
IN 310 PAGE=PEEK(106)-22
AG 320 BASE=PAGE*256:CK=0
OG 330 FOR MEMLOC=BASE TO BA
   SE+47
KF 340 READ DATA:CK=CK+DATA
MK 350 POKE MEMLOC,DATA
JF 360 NEXT MEMLOC
LO 365 IF CK<>4549 THEN ? "D
   ATA ERROR IN LINES 48
   00-4860":STOP
IN 400 PAGE=PEEK(106)-32
NB 410 BASE=PAGE*256
EO 430 POKE BASE+525,PAGE+2
EP 440 POKE BASE+534,PAGE+2
EO 450 POKE BASE+541,PAGE+2
EP 460 POKE BASE+550,PAGE+2
FN 470 POKE BASE+557,PAGE+2
FF 480 POKE BASE+805,PAGE+3
FI 490 POKE BASE+843,PAGE+3
FF 500 POKE BASE+884,PAGE+3
FA 510 POKE BASE+914,PAGE+3
FC 520 POKE BASE+942,PAGE+3
BP 530 POKE BASE+1026,PAGE
CD 540 POKE BASE+1029,PAGE
ML 550 POKE BASE+1032,PAGE+2
IB 560 POKE BASE+1054,PAGE+3
ID 570 POKE BASE+1109,PAGE+3
IJ 580 POKE BASE+1147,PAGE+6
IF 590 POKE BASE+1150,PAGE+7
NO 600 POKE BASE+1181,PAGE+4
ND 610 POKE BASE+1207,PAGE+4
IG 620 POKE BASE+1276,PAGE+5
IB 630 POKE BASE+1306,PAGE+5
IF 640 POKE BASE+1327,PAGE+5
IN 650 POKE BASE+1373,PAGE+5
IN 660 POKE BASE+1387,PAGE+5
ID 670 POKE BASE+1412,PAGE+5
IF 680 POKE BASE+1503,PAGE+5
IO 690 POKE BASE+1528,PAGE+6
IB 700 POKE BASE+1531,PAGE+7
ID 710 POKE BASE+1544,PAGE+4
IL 720 POKE BASE+1547,PAGE+8
IK 730 POKE BASE+1565,PAGE+6
JA 740 POKE BASE+1588,PAGE+6
II 750 POKE BASE+1606,PAGE+6
IJ 760 POKE BASE+1624,PAGE+6
IL 770 POKE BASE+1661,PAGE+6
IN 780 POKE BASE+1709,PAGE+4
IN 790 POKE BASE+1921,PAGE+7
IN 800 POKE BASE+1938,PAGE+7
IJ 810 POKE BASE+2076,PAGE+8
IL 820 POKE BASE+2095,PAGE+8
IC 830 POKE BASE+2112,PAGE+8
IE 840 POKE BASE+2131,PAGE+8
IN 850 POKE BASE+2148,PAGE+8
IH 860 POKE BASE+2222,PAGE+8
II 870 POKE BASE+2231,PAGE+8
JB 880 POKE BASE+2292,PAGE+9
IO 890 POKE BASE+2295,PAGE+2
IL 900 POKE BASE+2365,PAGE+9
IM 910 POKE BASE+2383,PAGE+9
IO 920 POKE BASE+2393,PAGE+9
JF 950 PRISDN=USR((PAGE+4)*2
   56)
KN 1000 DATA 169,112,141,150
   ,6,169,112
LH 1010 DATA 141,151,6,169,1
   98,141,152
OM 1020 DATA 6,169,0,141,153
   ,6,165
EN 1030 DATA 106,56,233,16,1
   41,154,6
CC 1040 DATA 162,0,169,13,15
   7,155,6
PC 1050 DATA 232,224,94,208,
   248,169,141
JL 1060 DATA 157,155,6,169,6
   5,157,156
GG 1070 DATA 6,169,150,157,1
   57,6,169
PI 1080 DATA 6,157,158,6,169
   ,0,141
PD 1090 DATA 47,2,169,150,14
   1,48,2
LP 1100 DATA 169,6,141,49,2,
   169,0
LI 1110 DATA 141,0,2,165,106
MA 1115 DATA 56,233,22,141,1
IE 1120 DATA 2,169,192,141,1
   4,212,169
OI 1130 DATA 34,141,47,2,169
   ,0,133
LL 1140 DATA 176,165,106,56,
   233,17,133
EM 1150 DATA 177,162,0,230,1
   77,160,0
LG 1160 DATA 169,0,145,176,2
   00,208,251
QD 1170 DATA 232,224,15,208,
   240,165,106
FE 1180 DATA 56,233,16,133,1
   77,160,1
IP 1190 DATA 169,16,145,176,
   200,192,5
LN 1200 DATA 208,249,160,15,
   169,80,145
OM 1210 DATA 176,200,192,19,
   208,249,160
LP 1220 DATA 8,169,213,145,1
   76,200,169
CB 1230 DATA 218,145,176,200
   ,169,208,145
OK 1240 DATA 176,200,145,176
   ,160,20,169
BP 1250 DATA 255,145,176,200
   ,192,180,208
CK 1260 DATA 249,169,116,133
   ,176,165,106
BO 1270 DATA 56,233,2,133,17
```

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```
        7,160,0
CB 1280 DATA 169,255,145,176
        ,200,192,160
MI 1290 DATA 208,249,169,0,1
        33,176,165
LB 1300 DATA 106,56,233,16,1
        33,177,162
IE 1310 DATA 0,160,20,169,25
        5,145,176
EI 1320 DATA 152,24,105,39,1
        44,2,230
DC 1330 DATA 177,168,169,255
        ,145,176,232
HG 1340 DATA 200,208,2,230,1
        77,224,20
IN 1350 DATA 208,229,165,106
        ,56,233,5
LN 1360 DATA 133,177,162,0,1
        60,244,169
MB 1370 DATA 255,145,176,152
        ,24,105,39
NI 1380 DATA 144,2,230,177,1
        68,169,255
LB 1390 DATA 145,176,232,200
        ,208,2,230
OK 1400 DATA 177,224,20,208,
        229,165,106
EG 1410 DATA 56,233,20,141,7
        ,212,133
JB 1420 DATA 177,169,3,141,2
        9,208,173
KK 1430 DATA 111,2,9,16,141,
        111,2
FO 1440 DATA 169,46,141,47,2
        ,169,132
FG 1450 DATA 141,192,2,141,1
        94,2,169
CA 1460 DATA 2,141,193,2,169
        ,15,141
PJ 1470 DATA 196,2,169,0,141
        ,197,2
LO 1480 DATA 169,136,141,200
        ,2,169,218 -
JI 1490 DATA 141,198,2,169,5
        0,141,199
FI 1500 DATA 2,198,177,162,0
        ,230,177
EK 1510 DATA 160,0,169,0,145
        ,176,200
KP 1520 DATA 208,251,232,224
        ,4,208,240
GI 1530 DATA 169,91,141,7,20
        8,169,93
CL 1540 DATA 141,6,208,169,9
        5,141,5
JL 1550 DATA 208,169,97,141,
        4,208,169
LF 1560 DATA 108,141,0,208,1
        69,125,141
FO 1570 DATA 1,208,169,142,1
        41,2,208
GI 1580 DATA 169,159,141,3,2
        08,169,6
IA 1590 DATA 141,0,6,141,1,6
        ,141
LL 1600 DATA 8,6,141,10,6,16
        9,151
MH 1610 DATA 141,2,6,169,79,
        141,9
LM 1620 DATA 6,169,0,141,18,
        6,141
IN 1630 DATA 25,6,169,1,141,
        16,6
OJ 1640 DATA 141,17,6,141,24
        ,6,141
PD 1650 DATA 26,6,169,240,14
        1,32,6
MD 1660 DATA 141,33,6,141,34
        ,6,96
PK 1700 DATA 169,128,133,178
        ,165,106,56
IJ 1710 DATA 233,19,133,179,
        32,47,130
IO 1720 DATA 169,0,133,178,2
        30,179,32
NO 1730 DATA 47,130,169,128,
        133,178,32
IJ 1740 DATA 47,130,169,0,13
        3,178,230
MG 1750 DATA 179,32,47,130,1
        69,128,133
FN 1760 DATA 178,32,47,130,9
        6,160,20
PG 1770 DATA 177,178,208,23,
        200,192,108
JF 1780 DATA 208,247,169,16,
        141,144,6
JO 1790 DATA 169,1,160,20,16
        9,255,145
PK 1800 DATA 178,200,192,108
        ,208,249,96
BO 2000 DATA 173,112,2,74,56
        ,201,79
PH 2010 DATA 144,2,169,78,14
        1,48,6
AP 2020 DATA 141,64,6,24,105
        ,10,141
IL 2030 DATA 49,6,141,66,6,1
        62,0
OJ 2040 DATA 160,1,169,80,14
        1,50,6
BO 2050 DATA 32,77,131,173,1
        13,2,74
DC 2060 DATA 56,201,79,144,2
        ,169,78
MA 2070 DATA 141,48,6,141,65
        ,6,24
BP 2080 DATA 105,10,141,49,6
        ,141,67
OK 2090 DATA 6,162,0,160,33,
        169,10
ON 2100 DATA 141,50,6,32,77,
        131,96
PC 2110 DATA 169,180,133,176
        ,165,106,56
IH 2120 DATA 233,16,133,177,
        169,0,236
FL 2130 DATA 48,6,176,22,145
        ,176,232
PL 2140 DATA 200,200,200,200
        ,200,145,176
EB 2150 DATA 152,24,105,35,1
        44,2,230
JL 2160 DATA 177,168,76,88,1
        31,173,50
PE 2170 DATA 6,236,49,6,240,
        22,145
PP 2180 DATA 176,200,200,200
        ,200,200,145
LI 2190 DATA 176,232,152,24,
        105,35,144
IG 2200 DATA 2,230,177,168,7
        6,117,131
FO 2210 DATA 169,0,224,88,24
        0,22,145
PH 2220 DATA 176,232,200,200
        ,200,200,200
LG 2230 DATA 145,176,152,24,
        105,35,144
IN 2240 DATA 2,230,177,168,7
        6,147,131
FC 2250 DATA 96
OD 2400 DATA 32,0,128,32,98,
        128,32
NG 2410 DATA 0,130,169,0,141
        ,0,210
OI 2420 DATA 141,2,210,141,4
        ,210,141
BO 2430 DATA 6,210,141,144,6
        ,133,77
BA 2440 DATA 32,0,131,173,12
        4,2,240
FK 2450 DATA 5,173,125,2,208
        ,243,169
PP 2460 DATA 208,141,96,6,14
        1,97,6
GK 2470 DATA 141,98,6,169,21
        3,141,99
FF 2480 DATA 6,169,168,141,1
        ,210,141
OC 2490 DATA 3,210,141,5,210
        ,141,7
EL 2500 DATA 210,169,0,141,1
        43,6,173
EK 2510 DATA 31,208,201,6,24
        0,176,32
NJ 2520 DATA 0,131,169,0,141
        ,0,210
BK 2530 DATA 141,2,210,141,4
        ,210,141
EL 2540 DATA 6,210,141,8,210
        ,173,144
PJ 2550 DATA 6,240,8,206,144
        ,6,169
BM 2560 DATA 53,141,6,210,16
        9,0,141
PF 2570 DATA 62,6,32,174,134
        ,32,54
AO 2580 DATA 135,174,62,6,18
        9,16,6
MH 2590 DATA 208,49,222,0,6,
        189,0
NK 2600 DATA 6,201,4,240,13,
        24,201
JO 2610 DATA 251,144,77,169,
        156,157,0
NA 2620 DATA 6,76,227,132,18
        9,8,6
BO 2630 DATA 56,201,16,144,5
        ,56,201
CP 2640 DATA 71,144,56,169,1
        ,157,16
PI 2650 DATA 6,169,29,141,2,
        210,76
PE 2660 DATA 227,132,254,0,6
        ,189,0
EJ 2670 DATA 6,201,154,240,1
        0,56,201
JL 2680 DATA 157,144,28,169,
        255,157,0
JO 2690 DATA 6,189,8,6,56,20
        1,16
BJ 2700 DATA 144,5,56,201,71
        ,144,10
AB 2710 DATA 169,0,157,16,6,
        169,29
CA 2720 DATA 141,2,210,189,2
        4,6,208
GI 2730 DATA 51,222,8,6,189,
        8,6
EP 2740 DATA 201,0,208,11,16
        9,29,141
NF 2750 DATA 2,210,254,24,6,
        76,75
FJ 2760 DATA 133,201,16,208,
        47,189,0
JA 2770 DATA 6,56,201,6,144,
        5,24
IN 2780 DATA 201,153,144,61,
        169,1,157
PB 2790 DATA 24,6,169,29,141
        ,2,210
AH 2800 DATA 76,75,133,254,8
        ,6,189
PI 2810 DATA 8,6,201,86,208,
        11,169
OG 2820 DATA 29,141,2,210,22
        2,24,6
FI 2830 DATA 76,75,133,201,7
        0,208,23
NF 2840 DATA 189,0,6,56,201,
        6,144
FH 2850 DATA 5,56,201,153,14
        4,10,169
PM 2860 DATA 0,157,24,6,169,
        29,141
PG 2870 DATA 2,210,189,16,6,
        208,14
LN 2880 DATA 189,0,6,201,5,2
```

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```
      40,21
IN 2890 DATA 201,25,240,17,7
      6,246,133
BM 2900 DATA 189,0,6,201,153
      ,240,32
LI 2910 DATA 201,133,240,28,
      76,246,133
PP 2920 DATA 169,1,141,68,6,
      173,64
JD 2930 DATA 6,141,69,6,173,
      66,6
CK 2940 DATA 141,70,6,169,80
      ,141,71
CN 2950 DATA 6,76,155,133,16
      9,0,141
NI 2960 DATA 68,6,173,65,6,1
      41,69
JL 2970 DATA 6,173,67,6,141,
      70,6
DK 2980 DATA 169,160,141,71,
      6,189,8
NG 2990 DATA 6,56,205,69,6,1
      44,82
CK 3000 DATA 24,205,70,6,176
      ,76,169
DC 3010 DATA 19,141,0,210,17
      3,71,6
PL 3020 DATA 157,32,6,173,68
      ,6,157
MC 3030 DATA 16,6,173,70,6,5
      6,253
IL 3040 DATA 8,6,24,201,6,17
      6,25
MO 3050 DATA 169,1,157,24,6,
      189,8
ON 3060 DATA 6,201,86,208,10
      ,169,0
PI 3070 DATA 157,24,6,169,29
      ,141,2
IM 3080 DATA 210,76,246,133,
      169,0,157
FN 3090 DATA 24,6,189,8,6,20
      1,0
OL 3100 DATA 208,10,169,1,15
      7,24,6
ED 3110 DATA 169,29,141,2,21
      0,32,174
ED 3120 DATA 134,32,104,135,
      238,62,6
LB 3130 DATA 173,62,6,201,3,
      240,3
EL 3140 DATA 76,121,132,32,0
      ,136,173
PM 3150 DATA 143,6,208,72,17
      3,96,6
CH 3160 DATA 201,159,240,6,2
      06,96,6
CP 3170 DATA 76,126,134,169,
      8,141,6
JB 3180 DATA 210,169,217,141
      ,96,6,173
CG 3190 DATA 97,6,201,208,24
      0,6,206
GF 3200 DATA 97,6,76,126,134
      ,169,217
PJ 3210 DATA 141,97,6,173,98
      ,6,201
PL 3220 DATA 208,240,6,206,9
      8,6,76
ID 3230 DATA 126,134,169,213
      ,141,98,6
CH 3240 DATA 173,99,6,201,20
      8,240,6
GK 3250 DATA 206,99,6,76,126
      ,134,169
BM 3260 DATA 32,162,0,157,12
      4,6,232
FJ 3270 DATA 157,124,6,232,1
      57,124,6
FD 3280 DATA 169,128,141,143
      ,6,169,0
DM 3290 DATA 141,1,210,141,3
      ,210,141
BF 3300 DATA 5,210,141,7,210
      ,76,161
LF 3310 DATA 134,165,106,56,
      233,16,133
HM 3320 DATA 181,169,0,133,1
      80,160;11
JE 3330 DATA 173,97,6,145,18
      0,136,173
JL 3340 DATA 98,6,145,180,13
      6,169,218
JH 3350 DATA 145,180,136,173
      ,99,6,145
LH 3360 DATA 180,162,52,160,
      23,136,208
MF 3370 DATA 253,202,208,248
      ,76,76,132
JM 3380 DATA 174,62,6,189,0,
      6,74
BM 3390 DATA 74,141,57,6,10,
      10,141
JL 3400 DATA 58,6,189,0,6,56
      ,237
PK 3410 DATA 58,6,141,59,6,1
      65,106
LP 3420 DATA 56,233,16,133,1
      81,169,180
FD 3430 DATA 24,109,57,6,133
      ,180,169
IC 3440 DATA 0,141,51,6,141,
      52,6
MK 3450 DATA 189,8,6,141,54,
      6,160
FE 3460 DATA 0,14,51,6,24,14
      ,54
LN 3470 DATA 6,144,3,238,51,
      6,200
GD 3480 DATA 192,5,208,239,1
      60,0,189
GC 3490 DATA 8,6,141,55,6,14
      ,52
FH 3500 DATA 6,24,14,55,6,14
      4,3
CA 3510 DATA 238,52,6,200,19
      2,3,208
CD 3520 DATA 239,173,54,6,24
      ,109,55
LD 3530 DATA 6,144,3,238,51,
      6,141
DL 3540 DATA 56,6,24,101,180
      ,144,2
IF 3550 DATA 230,181,133,180
      ,173,51,6
BP 3560 DATA 24,109,52,6,24,
      101,181
GC 3570 DATA 133,181,96,174,
      62,6,160
MF 3580 DATA 0,189,80,6,17,1
      80,93
GI 3590 DATA 80,6,145,180,20
      0,189,88
MD 3600 DATA 6,17,180,93,88,
      6,145
CI 3610 DATA 180,160,40,189,
      80,6,17
FF 3620 DATA 180,93,80,6,145
      ,180,200
BD 3630 DATA 189,88,6,17,180
      ,93,88
AE 3640 DATA 6,145,180,96,18
      9,32,6
AF 3650 DATA 157,80,6,157,88
      ,6,160
LP 3660 DATA 0,204,59,6,240,
      10,94
JK 3670 DATA 80,6,94,80,6,20
      0,76
CI 3680 DATA 115,135,160,4,2
      04,59,6
MH 3690 DATA 240,10,30,88,6,
      30,88
BP 3700 DATA 6,136,76,132,13
      5,160,0
GB 3710 DATA 189,80,6,17,180
      ,145,180
GD 3720 DATA 200,189,88,6,17
      ,180,145
CL 3730 DATA 180,160,40,189,
      80,6,17
JG 3740 DATA 180,145,180,200
      ,189,88,6
DM 3750 DATA 17,180,145,180,
      96
DK 4000 DATA 162,0,142,62,6,
      169,42
LI 4010 DATA 141,112,6,169,1
      48,133,184
LN 4020 DATA 165,106,56,233,
      19,133,185
DJ 4030 DATA 169,1,141,73,6,
      32,112
JC 4040 DATA 136,169,59,141,
      112,6,169
IJ 4050 DATA 20,133,184,230,
      185,169,5
FF 4060 DATA 141,73,6,32,112
      ,136,169
ID 4070 DATA 76,141,112,6,16
      9,148,133
CH 4080 DATA 184,169,10,141,
      73,6,32
IJ 4090 DATA 112,136,169,93,
      141,112,6
PA 4100 DATA 169,20,133,184,
      230,185,169
DG 4110 DATA 5,141,73,6,32,1
      12,136
LI 4120 DATA 169,110,141,112
      ,6,169,148
CF 4130 DATA 133,184,169,1,1
      41,73,6
FF 4140 DATA 32,112,136,238,
      62,6,174
PE 4150 DATA 62,6,224,3,208,
      150,96
BD 4160 DATA 162,0,189,112,6
      ,24,105
DM 4170 DATA 1,232,157,112,6
      ,224,8
DA 4180 DATA 208,245,174,62,
      6,189,0
CE 4190 DATA 6,56,205,112,6,
      144,108
BM 4200 DATA 24,162,8,221,11
      2,6,176
EL 4210 DATA 100,169,0,141,1
      40,6,169
PE 4220 DATA 128,141,72,6,17
      4,62,6
DP 4230 DATA 189,0,6,174,140
      ,6,221
CH 4240 DATA 112,6,208,3,76,
      184,136
MA 4250 DATA 238,140,6,78,72
      ,6,76
DK 4260 DATA 158,136,174,62,
      6,189,8
GM 4270 DATA 6,41,248,168,17
      7,184,45
AA 4280 DATA 72,6,240,48,189
      ,124,6
PH 4290 DATA 208,43,189,32,6
      ,141,2
FD 4300 DATA 210,177,184,77,
      72,6,162
EK 4310 DATA 0,145,184,200,2
      32,224,8
GG 4320 DATA 208,248,174,62,
      6,189,16
JH 4330 DATA 6,73,1,157,16,6
      ,169
DP 4340 DATA 40,157,124,6,32
      ,4,137
PD 4350 DATA 32,0,130,174,62
      ,6,189
DI 4360 DATA 124,6,240,3,222
      ,124,6
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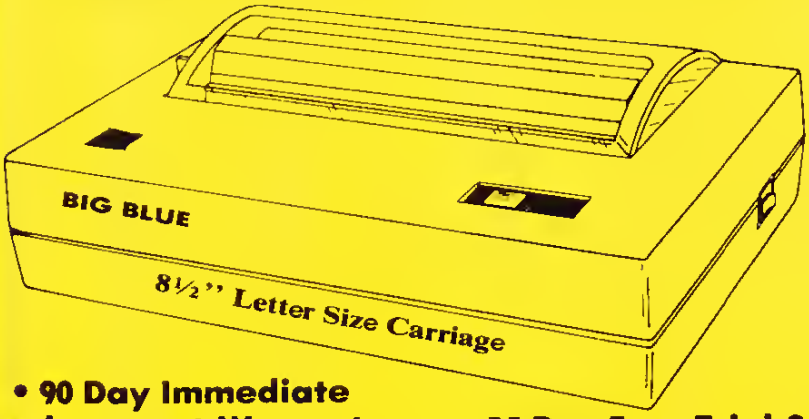

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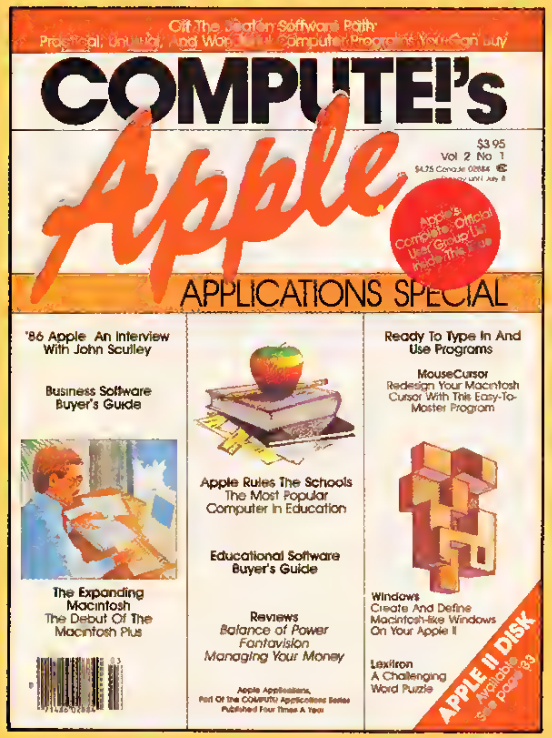

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```
DB 4370  DATA 96,173,73,6,240
         ,81,206
PH 4380  DATA 73,6,189,32,6,2
         01,240
JC 4390  DATA 240,71,169,0,13
         3,186,165
MC 4400  DATA 106,56,233,16,1
         33,187,169
CS 4410  DATA 16,141,74,6,169
         ,25,141
PF 4420  DATA 75,6,189,32,6,2
         01,160
CM 4430  DATA 208,15,169,80,1
         41,74,6
DH 4440  DATA 169,89,141,75,6
         ,160,18
SK 4450  DATA 76,64,137,160,4
         ,177,186
AC 4460  DATA 205,75,6,208,9,
         173,74
GM 4470  DATA 6,145,186,136,7
         6,64,137
JG 4480  DATA 177,186,24,105,
         1,145,186
BK 4490  DATA 76,4,137,96
SG 4800  DATA 72,138,72,169,5
         6,162,15
KK 4810  DATA 141,10,212,141,
         26,208,142
IK 4820  DATA 25,208,142,21,2
         08,169,32
BF 4830  DATA 141,0,2,104,170
         ,104,64
FF 4840  DATA 0,0,0,0,0,72,169,
         136
LH 4850  DATA 141,10,212,141,
         26,208,169
OP 4860  DATA 0,141,0,2,104,6
         4
```

Program 2: Commodore 64 Prisonball

Version by Kevin Mykytyn, Editorial Programmer

Please refer to the "MLX" article in this issue before entering the following listing.

```
0801:FF FF 0A 00 9E 32 30 36 A6
0809:31 00 00 00 A9 00 8D BA D4
0811:0F 20 E4 0D 20 BB 0A 20 42
0819:CA 0D 20 16 0E 20 39 0E A8
0821:20 3F 09 AD BA 0F D0 08 C8
0829:A9 01 8D BA 0F 4C 65 08 28
0831:CE FD 02 D0 0C AD FE 02 8C
0839:8D FD 02 20 E9 0C 20 BE 50
0841:08 CE FB 02 D0 0C AD FC B7
0849:02 8D F8 02 20 C3 0B 20 A3
0851:98 09 20 E1 FF D0 D9 AD 38
0859:00 DC 2D 01 DC 29 10 D0 D2
0861:F6 4C 31 08 AD 00 DC 2D FA
0869:01 DC 29 1F C9 1F D0 F4 A9
0871:A9 B0 8D 14 04 8D 16 04 FB
0879:8D 17 04 A9 03 8D 15 D0 7A
0881:A2 18 A0 0C 18 20 F0 FF E0
0889:A9 7F A0 0F 20 1E A8 78 9C
0891:A9 00 85 C6 AD 00 DC 2D E7
0899:01 DC 29 10 F0 0B AD 00 96
08A1:DC C9 7F F0 EF A9 00 F0 A8
08A9:02 A9 01 85 F7 0A 0A 0A A3
08B1:18 69 08 8D FB 02 8D FC 02
08B9:02 58 4C 12 08 A5 A2 C9 71
08C1:3C D0 37 A9 00 85 A2 AD AE
08C9:17 04 C9 B0 F0 06 CE 17 FE
08D1:04 4C FB 08 A9 B9 8D 17 5D
08D9:04 AD 16 04 C9 B0 F0 06 53
08E1:CE 16 04 4C FB 08 A9 B5 2D
08E9:8D 16 04 AD 14 04 C9 B0 96
08F1:D0 05 68 68 4C 65 08 CE 16
08BF9:14 04 AD 14 04 C9 B0 D0 85
0901:12 AD 16 04 C9 B2 D0 0B 50
0909:AD 17 04 C9 B0 D0 04 EE 94
0911:20 D0 60 A9 00 8D 20 D0 55
0919:60 A6 06 BD 27 D0 29 0F 7F
0921:C9 03 F0 19 AA AC B8 0F 11
0929:B9 4E 0F 18 7D B4 0F 9D 89
0931:84 0F 8D B6 0F 69 00 9D 40
0939:B6 0F 20 3F 09 60 A0 07 74
0941:AE 85 0F AD B7 0F 20 56 65
0949:09 A0 22 AE 84 0F AD 86 28
0951:0F 20 56 09 60 8C B9 0F 06
0959:86 FB 85 FC A2 08 A0 FF A4
0961:C8 A5 F8 48 38 FD 91 09 2B
0969:85 FB A5 FC 48 FD 92 09 2A
0971:85 FC 90 05 68 68 4C 61 C6
0979:09 68 85 FC 68 85 FB 98 94
0981:09 B0 AC B9 0F 99 00 04 58
0989:EE B9 0F CA CA 10 CF 60 A6
0991:01 00 0A 00 64 00 E8 03 5D
0999:10 27 A2 04 86 06 BD DF 89
09A1:02 38 E9 2A 29 F8 48 85 E5
09A9:FB A9 00 85 FC 06 FB 26 9A
09B1:FC 06 FB 26 FC 68 18 65 C4
09B9:FB 85 FB A5 FC 69 00 85 18
09C1:FC 8D D7 02 85 FE BD CF 50
09C9:02 85 FD A0 03 46 FE 66 9D
09D1:FD 88 D0 F9 A5 FD 38 E9 3E
09D9:02 85 FD A5 FE E9 00 85 8D
09E1:FE A5 FB 18 65 FD 85 FB 08
09E9:A5 FC 65 FE 85 FC A5 FC 13
09F1:18 69 D8 85 FC A0 00 B1 F9
09F9:F8 29 0F A2 03 CA 30 68 6C
0A01:DD 40 0F D0 F8 8E B8 0F 85
0A09:A5 FC 38 E9 D4 85 FC B1 3D
0A11:FB A2 03 CA 30 52 DD 45 A4
0A19:0F D0 F8 8A 0A A8 A6 06 F6
0A21:A5 FD 38 E9 0B 4A 4A DD 21
0A29:96 0F F0 3C 9D 96 0F 8D 51
0A31:BF 02 10 01 C8 B9 48 0F 84
0A39:A0 00 91 F8 20 74 0A C9 40
0A41:20 D0 1A A5 FD 38 E9 0B E6
0A49:4A 4A AA FE AA 0F 8D AA 12
0A51:0F C9 2E D0 08 A9 00 9D B6
0A59:AA 0F 20 9C 0C 20 1A 09 72
0A61:A6 06 20 65 0C 4C 68 0A 17
0A69:A6 06 CA E0 01 F0 03 4C D7
0A71:9D 09 60 48 8A 38 E9 02 32
0A79:A8 B9 B8 0A A8 A9 1E 99 C9
0A81:01 D4 A9 11 99 05 D4 A9 C5
0A89:80 99 04 D4 A9 81 99 04 9C
0A91:D4 68 60 48 8A 38 E9 02 C5
0A99:A8 B9 B8 0A A8 68 0A 0A 2D
0AA1:0A 18 69 0A 99 01 D4 A9 B2
0AA9:13 99 05 D4 A9 20 99 04 A0
0AB1:D4 A9 21 99 04 D4 60 00 8C
0AB9:07 0E A9 00 A0 17 99 00 9E
0AC1:D4 88 10 FA A9 0F 8D 18 D0
0AC9:D4 A9 FF 8D 0F D4 A9 80 28
0AD1:8D 12 D4 A9 14 8D FD 02 38
0AD9:8D FE 02 A9 00 85 A2 A0 4B
0AE1:04 99 AA 0F 99 84 0F 88 EA
0AE9:10 F7 A0 02 A2 4B AD 18 F0
0AF1:D4 10 02 A2 B4 8A 99 C1 A3
0AF9:02 A9 06 99 98 0F 88 10 F5
0B01:EB 60 BD D7 02 D0 17 BD 99
0B09:CF 02 C9 0A D0 26 A9 14 E7
0B11:9D 96 0F A9 4D 9D CF 02 9A
0B19:A9 01 9D D7 02 60 BD CF 52
0B21:02 C9 4E D0 0F A9 14 9D 66
0B29:96 0F A9 08 9D CF 02 A9 0E
0B31:00 9D D7 02 60 BD D7 02 75
0B39:D0 2E BD BF 02 10 28 BD 55
0B41:CF 02 C9 1B F0 04 C9 45 1B
0B49:D0 1D AD DF 02 38 FD DF 8F
0851:02 C9 F5 B0 04 C9 0F 80 BA
0B59:0E 20 9C 0B A9 01 9D 27 76
0B61:D0 20 94 0A 4C 93 0B 60 42
0B69:BD BF 02 30 FA BD CF 02 02
0B71:C9 3D F0 04 C9 13 D0 EF 46
0B79:AD E0 02 38 FD DF 02 C9 9F
0B81:F5 B0 04 C9 0F 80 E0 20 F8
0B89:9C 0B A9 00 9D 27 D0 20 31
0B91:94 0A A9 14 9D 96 0F 20 70
0B99:65 0C 60 C9 00 D0 0B AD 15
0BA1:04 DC 10 04 A9 FF D0 02 24
0BA9:A9 01 20 AB 0E 08 10 03 47
0881:20 AB 0E 0A 0A 18 69 0A B2
0BB9:28 10 03 20 AB 0E 9D C7 E2
0BC1:02 60 A2 04 20 03 0B 20 C8
08C9:17 0C 20 45 0C C9 31 F0 A1
0BD1:04 C9 E5 D0 03 20 83 0C D1
08D9:8D 8F 02 10 0E BD CF 02 09
0BE1:C9 14 D0 26 8D D7 02 D0 80
0BE9:21 F0 0C BD CF 02 C9 44 88
08F1:D0 18 8D D7 02 F0 13 8D 63
08F9:DF 02 C9 57 90 04 C9 BE 16
0C01:90 08 A9 14 9D 96 0F 20 5F
0C09:65 0C 20 36 0B CA E0 01 84
0C11:F0 03 4C C5 08 60 A0 00 63
0C19:BD BF 02 10 02 A0 FF 8C 60
0C21:F8 02 8C F9 02 BD EF 02 50
0C29:18 7D BF 02 9D EF 02 8D 33
0C31:CF 02 6D F8 02 9D CF 02 17
0C39:8D D7 02 29 01 6D F9 02 AC
0C41:9D D7 02 60 A0 00 BD C7 AC
0C49:02 10 02 A0 FF 8C FA 02 DA
0C51:8D E7 02 18 7D C7 02 9D B0
0C59:E7 02 BD DF 02 6D FA 02 59
0C61:9D DF 02 60 BD BF 02 20 97
0C69:AB 0E 9D BF 02 BD CF 02 33
0C71:85 06 20 17 0C BD CF 02 3C
0C79:C5 06 F0 F6 20 17 0C 4C 45
0C81:17 0C BD C7 02 20 AB 0E 52
0C89:9D C7 02 8D DF 02 85 06 96
0C91:20 45 0C 8D DF 02 C5 06 01
0C99:F0 F6 60 8A 48 A9 33 85 71
0CA1:F8 A9 33 85 FD A9 04 85 05
0CA9:FC A9 D8 85 FE 8A 0A 0A 5E
0C81:A8 8D 40 0F 85 F9 A2 16 F5
0C89:A9 A0 91 F8 C8 91 FB 88 CD
0CC1:A5 F9 91 FD C8 91 FD 88 4E
0CC9:A5 F8 18 69 28 85 F8 A5 42
0CD1:FC 69 00 85 FC A5 FD 18 AD
0CD9:69 28 85 FD A5 FE 69 00 3D
0CE1:85 FE CA 10 D3 68 AA 60 CC
0CE9:A5 F7 F0 26 A2 01 BD 00 E7
0CF1:DC 4A B0 0D 8D DF 02 C9 2D
0CF9:3B F0 13 DE DF 02 4C 0F EA
0D01:0D 4A B0 0A BD DF 02 C9 26
0D09:DC F0 03 FE DF 02 CA 10 CA
0D11:DD 60 78 AD 02 DC 48 A9 D9
0D19:C0 8D 02 DC A9 80 8D 00 6F
0D21:DC A0 80 EA 88 D0 FC A2 B4
0D29:01 BD 19 D4 C9 38 80 04 44
0D31:A9 38 D0 06 C9 DC 90 02 4E
0D39:A9 DC 48 8A 0A 0A 0A 18 B5
0D41:69 BD 85 FB A9 0F 69 00 4C
0D49:85 FC BD 88 0F A8 68 91 56
0D51:F8 C0 07 D0 07 A9 00 9D 04
0D59:88 0F F0 03 FE BB 0F A9 12
0D61:00 85 FD 85 FE A0 07 A5 23
0D69:FD 18 71 FB 85 FD A5 FE E4
0D71:69 00 85 FE 88 10 F0 A5 EC
0D79:FD 46 FE 6A 46 FE 6A 46 F3
0D81:FE 6A 9D DF 02 CA 10 A1 64
0D89:68 8D 02 DC 58 60 A9 01 E1
0D91:8D 19 D0 A2 0E A0 07 A9 A7
0D99:00 85 02 89 CF 02 9D 00 B2
0DA1:D0 B9 DF 02 9D 01 D0 B9 FA
0DA9:D7 02 4A 26 02 CA CA 88 35
0DB1:10 E9 A5 02 8D 10 D0 A9 1B
0DB9:FA 8D 12 D0 AD 0D DC 29 88
0DC1:01 F0 03 4C 31 EA 4C BC 48
0DC9:FE A9 7F 8D 0D DC A9 8F 55
0DD1:8D 14 03 A9 0D 8D 15 03 7E
0DD9:A9 1B 8D 11 D0 A9 81 8D 10
0DE1:1A D0 60 A0 7F B9 B1 0E A7
0DE9:99 40 03 88 10 F7 A9 0E 88
0DF1:8D F8 07 8D F9 07 A9 0D 17
0DF9:A0 02 99 FA 07 88 10 FA 3D
0E01:A9 1F 8D 15 D0 A9 03 8D 7D
0E09:1D D0 A2 02 A9 32 9D C9 77
0E11:02 CA 10 F8 60 A0 04 B9 B9
0E19:31 0F 99 CF 02 89 36 0F 34
0E21:99 D7 02 B9 3B 0F 99 DF 05
0E29:02 B9 34 0E 99 27 D0 88 AF
0E31:10 E5 60 01 00 03 03 03 FF
0E39:A9 93 20 D2 FF A9 0B 8D 8A
```

```
ØE41:21 DØ A9 ØØ 8D 2Ø DØ AØ 86
ØE49:27 A9 AØ 99 ØØ Ø4 99 CØ 15
ØE51:Ø7 A9 ØF 99 ØØ D8 99 CØ 2E
ØE59:DB 88 1Ø ED AØ C8 A9 AØ 82
ØE61:99 ØØ Ø4 99 27 Ø4 99 F8 D9
ØE69:Ø6 99 1F Ø7 A9 ØF 99 ØØ FF
ØE71:D8 99 27 D8 99 F8 DA 99 D2
ØE79:1F D8 98 38 E9 28 A8 C9 BD
ØE81:D8 DØ DB A2 Ø4 2Ø 9C ØC C9
ØE89:CA 1Ø FA A2 ØØ AØ Ø1 18 35
ØE91:2Ø FØ FF A9 51 AØ ØF 2Ø DF
ØE99:1E AB A2 18 AØ ØF 18 2Ø 17
ØEA1:FØ FF A9 74 AØ ØF 2Ø 1E 52
ØEA9:AB 6Ø 49 FF 18 69 Ø1 6Ø A5
ØEB1:ØØ ØØ ØØ ØØ ØØ ØØ ØØ CD
ØEB9:ØØ ØØ ØØ ØØ ØØ ØØ ØØ D5
ØEC1:ØØ ØØ ØØ ØØ ØØ ØØ ØØ DD
ØEC9:ØØ ØØ ØØ 18 ØØ ØØ 3C E2
ØED1:ØØ ØØ 3C ØØ ØØ 18 ØØ ØØ D5
ØED9:ØØ ØØ ØØ ØØ ØØ ØØ ØØ F5
ØEE1:ØØ ØØ ØØ ØØ ØØ ØØ ØØ FD
ØEE9:ØØ ØØ ØØ ØØ ØØ ØØ ØØ 7F 85
ØEF1:CØ ØØ Ø3 CØ ØØ Ø3 CØ ØØ 68
ØEF9:Ø3 CØ ØØ Ø3 CØ ØØ Ø3 CØ C4
ØF01:ØØ Ø3 CØ ØØ Ø3 CØ ØØ Ø3 16
ØF09:CØ ØØ Ø3 CØ ØØ Ø3 CØ ØØ 81
ØF11:Ø3 CØ ØØ Ø3 CØ ØØ Ø3 CØ DD
ØF19:ØØ Ø3 CØ ØØ Ø3 CØ ØØ Ø3 2E
ØF21:CØ ØØ Ø3 CØ ØØ Ø3 CØ ØØ 99
ØF29:Ø3 CØ ØØ Ø3 CØ ØØ Ø3 Ø8 3D
ØF31:21 1F ØC ØC ØC ØØ Ø1 ØØ 4C
ØF39:ØØ ØØ 82 82 82 8C 96 ØA 4D
ØF41:Ø3 ØD Ø3 ØA AØ E1 61 E1 56
ØF49:61 2Ø 2Ø 2Ø 2Ø ØA 14 1E 95
ØF51:9B 12 53 43 4F 52 45 2Ø CE
ØF59:2Ø 2Ø 2Ø 2Ø 2Ø 2Ø 2Ø 2Ø 77
ØF61:54 49 4D 45 2Ø 33 3A 3Ø 6C
ØF69:3Ø 2Ø 2Ø 2Ø 2Ø 53 43 4F D1
ØF71:52 45 ØØ 5Ø 52 49 53 4F BC
ØF79:4E 42 41 4C 4C ØØ 5Ø 52 91
ØF81:45 53 53 2Ø 46 49 52 45 C4
ØF89:42 55 54 54 4F 4E ØØ ØØ A1
```

Program 3: Apple II Prisonball

Version by Tim Victor, Editorial Programmer

Please refer to the "Apple MLX" article in this issue before entering the following listing

```
START ADDRESS:  1000
END ADDRESS:    1647
```

```
1000: 20 31 14 20 58 14 A9 01 68
1008: BD A7 16 A0 07 B9 78 04 B9
1010: 99 CE 16 A9 33 99 78 04 03
1018: BB 10 F2 A9 3C BD D6 16 55
1020: A9 43 BD 0D 16 20 2A 13 01
1028: 20 9D 13 20 55 13 A9 00 6E
1030: BD 67 15 20 54 15 20 2F FB
1038: 15 20 A2 14 A9 01 BD 67 54
1040: 15 20 54 15 20 2F 15 20 D6
1048: A2 14 A0 02 98 0A 69 26 D8
1050: 99 A8 16 20 BB 15 10 03 C0
1058: A9 06 2C A9 21 99 B1 16 D7
1060: A9 0E 99 B7 16 A9 0A 99 BC
1068: BA 16 A9 B8 99 C0 16 AD D5
1070: DD 12 99 C3 16 A9 00 99 64
1078: B4 16 99 AE 16 A9 FF 99 B7
1080: BD 16 B8 10 C7 A9 33 CD 30
1088: B0 C0 D0 FB A0 F6 A2 00 31
1090: E8 D0 FD CB D0 FA AD A7 1B
1098: 16 D0 11 20 54 15 20 CF 23
10A0: 15 20 7B 15 AD A7 16 F0 3D
10A8: 03 20 E0 12 A9 33 CD B0 F5
10B0: C0 D0 F8 2C 51 C0 AD A7 38
10B8: 16 F0 1A 30 10 AD 61 C0 21
10C0: 0D 62 C0 10 0B A9 00 BD BD
10C8: A7 16 4C 1B 10 A2 9C EB AA
10D0: D0 FD 4C FE 10 A9 00 BD 07
10D8: AB 16 A9 43 8D 0D 16 20 29
10E0: E0 12 20 40 11 AD A8 16 A4
10E8: D0 09 20 D3 14 20 2F 15 B9
10F0: 20 A2 14 20 FE 12 AD 67 51
10F8: 15 49 01 8D 67 15 A9 33 05
1100: CD B0 C0 D0 F8 A2 9C E8 E6
1108: D0 FD 2C 50 C0 AD 00 C0 1A
1110: 10 16 C9 B3 F0 15 2C 10 75
1118: C0 AD A7 16 F0 02 10 0B 14
1120: A9 FF 4D A7 16 8D A7 16 B7
112B: 4C 96 10 2C 51 C0 A0 07 80
1130: B9 CE 16 99 7B 04 BB 10 34
113B: F7 BD 10 C0 20 5B FC 60 B4
1140: A2 02 BC 81 16 BD C0 16 26
114B: 1B 7D B4 16 9D B4 16 90 4A
1150: 01 CB BD C0 16 10 01 88 64
115B: 9B 9D B1 16 BC AB 16 BD 44
1160: C3 16 1B 7D AE 16 9D AE 7C
116B: 16 90 01 C8 BD C3 16 10 9F
1170: 01 88 C0 01 D0 0B A0 02 53
117B: A9 00 3B FD C3 16 9D C3 CB
1180: 16 C0 30 D0 0B A0 2F A9 D3
1188: 00 3B FD C3 16 9D C3 16 79
1190: 9B 9D AB 16 BE A6 16 8D 36
119B: AB 16 8D A4 16 BC B1 16 2F
11A0: 20 0B 14 AD A5 16 AE A6 7C
11AB: 16 C0 09 80 5F C0 01 B0 E2
11B0: 1E C9 00 D0 0D A9 FF 9D 0E
11BB: 8D 16 A9 01 9D B1 16 4C 80
11C0: C9 12 A9 FF 9D 8D 16 A9 3B
11CB: 26 9D B1 16 4C D2 12 C9 9B
11D0: 0F D0 36 8D C0 16 10 31 01
11D8: A9 40 8D 0D 16 FE B1 16 8B
11E0: 38 BD AB 16 ED A9 16 A8 50
11EB: C0 03 D0 0A 20 B8 15 30 70
11F0: 03 A0 02 2C A0 04 B9 D9 22
11F8: 12 9D C3 16 A9 FF 9D 8D A8
1200: 16 A9 0F 9D B7 16 4C C9 CD
1208: 12 4C D2 12 C0 1F 90 5F C6
1210: C0 27 90 1E C9 00 D0 0D 4F
1218: A9 FF 9D BD 16 A9 26 9D E1
1220: B1 16 4C C9 12 A9 FF 9D 9D
122B: BD 16 A9 01 9D B1 16 4C 22
1230: D2 12 C9 00 D0 36 8D C0 17
123B: 16 30 31 A9 41 8D 0D 16 A4
1240: DE B1 16 38 BD AB 16 ED 3D
1248: AA 16 A8 C0 03 D0 0A 20 F7
1250: B8 15 30 03 A0 02 2C A0 BB
1258: 04 B9 D9 12 9D C3 16 A9 18
1260: FF 9D 8D 16 A9 00 9D B7 45
126B: 16 4C C9 12 4C D2 12 C9 A0
1270: 01 F0 0E C9 06 F0 07 C9 7B
127B: 0C D0 57 A9 02 2C A9 01 71
1280: 2C A9 00 8D CB 16 C0 14 4A
128B: 90 05 3B 49 FF 69 04 DD 5D
1290: 8D 16 F0 3E 9D BD 16 20 48
129B: 95 15 AA A9 42 BD 0D 16 35
12A0: DE C6 16 F0 19 AE A6 16 9E
12AB: 8D A8 16 BD A4 16 A9 0A 0D
12B0: BD A5 16 8C 81 16 20 E0 9A
12BB: 13 AE A6 16 10 0B 20 5E 93
12C0: 13 A9 01 8D AB 16 AE A6 73
12CB: 16 3B A9 00 FD C0 16 9D F7
12D0: C0 16 CA 30 03 4C 42 11 16
12DB: 60 B0 D0 EB 00 18 30 50 13
12E0: A2 02 BE A6 16 8D A8 16 2B
12E8: BD A4 16 8D BA 16 8D A5 BA
12F0: 16 8C B1 16 20 E0 13 AE 40
12FB: A6 16 CA 10 E5 60 A2 00 46
1300: BE A6 16 BD AB 16 BD A4 2B
130B: 16 8C B1 16 20 0B 14 AE 04
1310: A6 16 AD A5 16 9D BA 16 D1
1318: 8D B7 16 BD A5 16 20 E0 4D
1320: 13 AE A6 16 E8 E0 03 D0 53
1328: D7 60 2C 50 C0 2C 56 C0 01
1330: 2C 52 C0 A0 00 BC A4 16 84
1338: B9 44 16 B5 EC 89 74 16 84
1340: 85 ED A9 AA A0 27 91 EC 36
1348: B8 10 FB AC A4 16 C8 CB D8
1350: C0 30 90 E1 60 A2 04 20 C8
1358: 5E 13 CA 10 FA 60 A9 5C D5
1360: 9D C6 16 BD 93 13 AB 19 FB
136B: 4B 14 BD 83 13 A0 2E 8C A5
1370: 8D 13 B9 44 16 1B 7D 98 42
1378: 13 8D B7 13 89 74 16 8D 07
1380: B8 13 A9 00 A0 01 99 FF 21
138B: FF BB 10 FA A0 00 BB B8 21
1390: D0 DD 60 01 06 0C 06 01 20
1398: 0B 0F 13 17 1B A0 00 8C C3
13A0: A5 16 A9 02 8D A4 16 A0 40
13A8: 00 20 E0 13 A0 27 20 E0 E6
13B0: 13 EE A4 16 AD A4 16 C9 08
13B8: 08 D0 EC A9 27 8D A4 16 9F
13C0: A0 00 20 E0 13 A0 27 20 D2
13C8: E0 13 EE A4 16 AD A4 16 13
13D0: C9 30 D0 EC A0 27 89 1C 02
13DB: 16 99 00 04 88 10 F7 60 B5
13E0: AE A4 16 BD 44 16 B5 EC 98
13EB: BD 74 16 85 ED A9 01 2C 6A
13F0: A4 16 F0 0D 81 EC 29 0F B0
13FB: AE A5 16 1D 48 14 91 EC 17
1400: 60 81 EC 29 F0 0D A5 16 12
1408: 91 EC 60 AE A4 16 BD 44 6B
1410: 16 B5 EC BD 74 16 B5 ED 13
141B: A9 01 2C A4 16 F0 0A 81 5F
1420: EC 4A 4A 4A 4A BD A5 16 29
1428: 60 81 EC 29 0F BD A5 16 2D
1430: 60 A2 00 BA 4A 20 47 F8 34
1438: A5 26 9D 44 16 A5 27 9D E7
1440: 74 16 EB E0 30 90 EC 60 51
144B: 00 10 20 30 40 50 60 70 EF
1450: B0 90 A0 B0 C0 D0 E0 F0 F7
145B: A9 00 A0 00 99 00 40 99 50
1460: 00 41 99 00 42 99 00 43 C7
146B: C8 D0 F1 A9 B0 BD 00 40 7C
1470: BD 20 40 BD 00 41 BD 10 7B
147B: 41 BD 20 41 BD 30 41 BD F9
1480: 00 42 BD 15 42 BD 28 42 1D
148B: A0 00 B9 00 40 99 40 40 61
1490: B9 00 41 99 40 41 B9 00 D1
149B: 42 99 40 42 CB C0 C0 D0 10
14A0: E9 60 AD 67 15 D0 16 A9 C3
14AB: 0F BD A5 16 A0 01 AD A9 DF
14B0: 16 20 04 15 A0 04 AD A9 D7
14BB: 16 20 04 15 60 A9 00 BD FC
14C0: A5 16 A0 23 AD AA 16 20 E8
14CB: 04 15 A0 26 AD AA 16 20 13
14D0: 04 15 60 AD 67 15 D0 16 6E
14DB: A9 0A BD A5 16 AD A9 16 35
14E0: A0 01 20 04 15 A0 04 AD 8E
14EB: A9 16 20 04 15 60 A9 0A 37
14F0: BD A5 16 AD AA 16 A0 23 FB
14FB: 20 04 15 A0 26 AD AA 16 32
1500: 20 04 15 60 BD A4 16 20 2F
150B: E0 13 EE A4 16 20 E0 13 95
1510: EE A4 16 20 E0 13 EE A4 75
151B: 16 20 E0 13 EE A4 16 20 FB
1520: E0 13 EE A4 16 20 E0 13 AD
152B: EE A4 16 20 E0 13 60 AD 79
1530: 67 15 D0 10 AD CC 16 1B 53
153B: 69 02 C9 29 90 02 A9 29 6C
1540: BD A9 16 60 AD CD 16 1B 4D
154B: 69 02 C9 29 90 02 A9 29 7C
1550: BD AA 16 60 AD 70 C0 A2 08
155B: 0A CA D0 FD 24 FF 8E CC 3F
1560: 16 8E CD 16 A0 2E A2 FF 57
156B: BD 64 C0 10 0A FE CC 16 9F
1570: 20 0B 16 B8 D0 F0 60 A9 AC
157B: FF 30 F5 A0 B0 A2 02 CA 56
1580: D0 FD 24 FF 20 08 16 B8 EC
158B: D0 FA 60 A5 4E 0A 0A 3B 27
1590: 65 4E 85 4E 60 4B 8D B7 ED
159B: 16 F0 06 C9 0F F0 05 6B 16
15A0: 60 A2 25 2C A2 0A FE 00 46
15AB: 04 CE CB 16 10 FB BD 00 43
15B0: 04 C9 BA 90 15 E9 0A 9D B1
15BB: 00 04 CA E0 06 F0 0B E0 36
15C0: 21 F0 07 A9 00 BD CB 16 17
15CB: F0 DC AE A6 16 6B 60 CE C4
15D0: D6 16 F0 01 60 A9 3C 8D C9
15DB: D6 16 AE 17 04 CA E0 B0 F8
15E0: B0 12 AE 16 04 CA E0 B0 DC
15EB: B0 05 CE 14 04 A2 B5 8E 6C
15F0: 16 04 A2 B9 8E 17 04 8A 7A
15FB: 0D 16 04 0D 14 04 29 0F 92
1600: D0 05 A9 01 8D A7 16 60 82
160B: EE 0C 16 2C FF FF 30 03 97
1610: EA 10 03 AD 30 C0 A2 03 BD
1618: CA D0 FD 60 A0 D3 C3 CF 4F
1620: D2 C5 A0 B0 B0 B0 B0 A0
162B: A0 A0 A0 D4 C9 CD C5 A0 DF
1630: B3 BA B0 B0 A0 A0 A0 A0 6F
1638: D3 C3 CF D2 C5 A0 B0 B0 29
1640: B0 B0 B0 A0 A0 A0 A0 A0 7A
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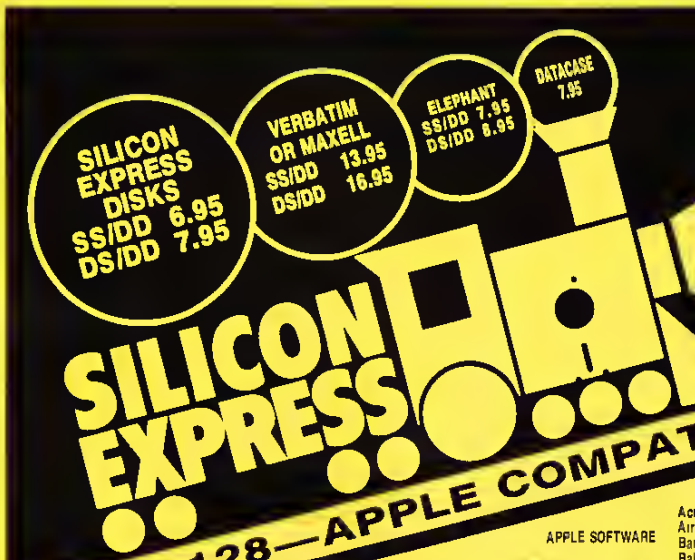

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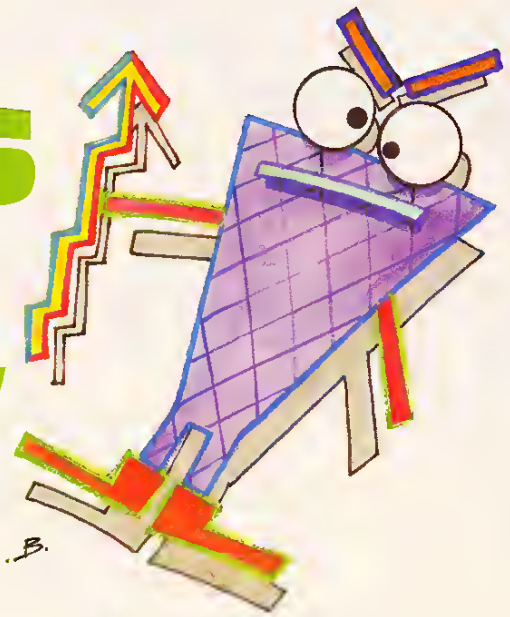
Lumpies Of Lotus IV

John and Jeff Klein



This whimsical game casts you in the role of a spy on a hostile planet and features a realistic, three-dimensional maze. It runs on the IBM PCjr with cartridge BASIC, or on the PC with BASICA and color/graphics adapter.

When "Lumpies Of Lotis IV" begins, intergalactic trade ships have been hijacked near the planet Lotis IV, and economic crisis threatens the galaxy. Lotis IV is inhabitated by Lumpies—a primitive, but cunning tribe of creatures who live underground. Although their technology is crude, the Lumpies are famous for their ability to put almost anything to use as a weapon. You have been dispatched to spy on the Lumpies and discover whether they are indeed hijacking cargo ships. If the Lumpies have taken prisoners from the crews of the missing ships, you must free the captives as well.

During your approach to Lotis IV, a severe atmospheric storm sends your spacecraft plummeting to the planet's surface. When your mind clears after the accident, you find yourself wandering in a warren of underground caves, without any weapons or communications gear. Your only hope for survival is to find the Lumpies' communications center so you can summon a rescue team from home—freeing any prisoners you find on the way. The more prisoners you rescue, the greater your reward will be after returning to your home planet.

3-D Adventure

Type in the game and save a copy before you run it. The screen displays two different views of your adventure at all times. The right side of the screen displays a map of the current level of the Lumpies' extensive system of caverns. The map shows only the rooms that you have already visited. The arrow on the map shows your present location and which direction you are facing. The left side of the screen gives you a three-dimensional view of what's in front of you.

The game is played entirely with keyboard controls. To move or change direction, press the appropriate cursor key. The cursor-left and -right keys move you left and right, respectively. The cursor-up key moves you forward (in the direction you're facing), and the cursor-down key reverses your direction 180 degrees. The W key toggles the 3-D window off and on. The X key toggles the two-dimensional map display off and on. To check your current status, press the S key. At other points in the game (fights, for instance) the program prompts you with additional choices.

You start with a strength rating of 20 and no weapons in your possession. Your strength decreases by a factor of 1 whenever a Lumpie hits you during a fight. Your strength is replenished whenever you enter a cave containing food. Don't let your strength dwindle to 0—if that happens, your mission ends immediately.

Unearthly Contests

In the peculiar world of Lotis IV, even seemingly innocuous objects such as wrenches and yo-yos can be used in a fight. Each object's power is rated on a scale of 1 to 9, and the power rating is more important than the object's description. For instance, a yo-yo with a power of 4 is more effective than a wrench with a power of 1.

To obtain a weapon, you must defeat the Lumpie who wields it. In these contests, the one holding the higher-powered object has the best chance for victory. Randomness plays a key part in these struggles, however. Since any weapon may break on occasion, don't be too foolhardy. You can always choose to flee the scene rather than start a

fight or continue one that's going badly. If you flee from a fight, the Lumpie regains his original vigor and remains in the same location. When you defeat a Lumpie, the creature surrenders its weapon to you and disappears in humiliation, never to return to the caves.

Prisoners are found at various locations within the underground maze; they are freed automatically when you encounter them. Certain caves also contain ladders which allow you to move between the first and second levels. To complete the game, you must find the communications room and call home for rescue. You can free additional prisoners after calling the home planet, but you won't win until you return to home base. You do this by checking your current status and answering yes when the program asks whether you want to go home.

It takes considerable skill (and a certain amount of luck) to complete the game successfully. If you and a Lumpie engage in a struggle with objects of equal power, the outcome is unpredictable. The map layout remains much the same each time you play, however, so with practice you'll learn the best route to victory.

Design Your Own Maze

Lumpies of Lotis IV is designed to offer a reasonable challenge to most players. With a few changes, you can alter the level of difficulty to make it easier for younger players to solve, or increase the challenge for anyone who has mastered the usual game. In addition to rearranging the rooms and objects on the existing levels, you can add entirely new levels of your own.

The DATA statements at the end of the program contain all the information for the maze. Each level is 22 squares long and 20 squares wide; the information for that level is represented by 22 DATA statements, each of which contains 20 numbers from the range 0–8. Here's an explanation of what each number means:

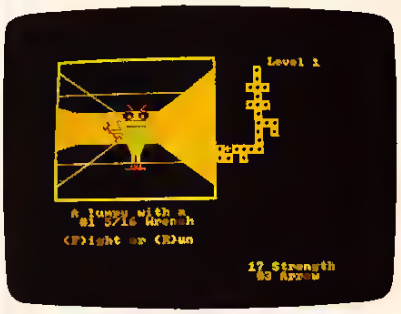
0 wall
1 empty corridor
2 door
3 not used
4 ladder
5 Lumpie
6 food
7 prisoner
8 communications room

The first five numbers in this list are easy to understand. Wherever a 0 appears in the DATA statements, the program creates a wall in the maze. The value 1 signifies an open corridor, and 2 stands for a door. The value 3 is not used; 4 creates a ladder.

The value 5 indicates an 85-percent chance that a Lumpie will appear in that section of the maze. Where the value 6 appears, the program determines randomly how much food to place in that cave. A prisoner is indicated by the value 7. The number 8 stands for the communications room. To keep the original character of the game, you should not include more than one communications room. (Note that it's impossible to travel through the communications room. If you change this room's location, make sure that it's placed at the end of a corridor.)

When customizing the program, make sure that the entry to the first level is not a wall (this is the sixth number in the first DATA statement). For a game of average difficulty, the number of Lumpies (5) and the amount of food (6) should proportionally be about equal on each level. This pattern gives the player a fair chance of surviving long enough to complete the game. To change the game's difficulty, simply alter the balance between Lumpies and food. The more Lumpies you find in relation to food, the more difficult the game, and vice versa. Note that these factors aren't absolute: After it reads the DATA statements, the program adds a few random Lumpies to the maze.

As written, the game includes two complete levels. To create a third level, you must add 22 DATA statements at the end of the program and change the variable LEVELS in line 90 from 2 to 3. The arrangement of numbers in the DATA statements corresponds exactly to the two-dimensional map displayed on the right part of the screen. If you're not sure how this works, run the program and draw a map of the entire first level; then compare this map to the DATA statements in lines 2010–2220.



In "Lumpies of Lotis IV," the computer always displays two views of your progress through a complex underground maze. In this screen, a Lumpie impedes your progress temporarily.

Lumpies Of Lotis IV

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
DJ 10 D1$(0)="C1BM2,43M+10,+3D62
      BH3P1,1":D1$(1)="C1BM2,43M
      +10,+3ND62BL10P0,1C1R10D62
      L10BE3P3,1":D2$(0)="C1BM15
      6,43M-10,+3D62BE3P1,1":D2$
      (1)="C1BM156,43M-10,+3ND62
      BR10P0,1C1L10D62R10BH3P3,1
      "
OH 20 D5$(1)="C1BM74,60D17M-5,+1
      BU40NF5R20NG5D40M-5,-1BU17
      BU3P0,1":D4$(1)="C1BM41,B9
      U34M+B,+2D26LBBFP0,1":D6$(
      1)="C1BM117,B9U34M-B,+2D26
      RBBGP0,1":D5$(0)="C1BM69,9
      5U40R20D40BH2P1,1":D4$(0)=
      LEFT$(D4$(1),21)+"BH2P1,1"
AB 30 D6$(0)=LEFT$(D6$(1),22)+"B
      E2P1,1":D9$(1)="C1BM74,77U
      17R10D17BH2P0,1":DB$(1)="C
      1BM34,77U17R10D17BH2P0,1":
      D10$(1)="C1BM114,77U17R10D
      17BH2P0,1":D9$(0)=LEFT$(D9
      $(1),22)+"1,1":DB$(0)=LEFT
      $(DB$(1),22)+"1,1":D10$(0)
      =LEFT$(D10$(1),23)+"1,1"
MJ 40 W$(1)="C2D5R3D15L7U15R3BD2
      P0,2C2U7D20RU15":W$(2)="C2
      BH5E2H2DF2G4H2UF2E1F10G1F2
      DH2E4F2UH2G2H10DF10":W$(3)
      ="C2U4L10DR6D3R4":W$(4)="C
      2BF10H6E2H6E2H6E2H6ND4NR4"
      :W$(5)="C2D15LGD2FR2EU2HL"
      :W$(6)="C2BU3NU6L4U6DR3BGP
      0,2":W$(7)="C2BU3L3H2U3E2R
      NU3R2F2D3G2BUP0,2
CN 50 KEY OFF:DEF SEG=0:POKE 104
      7,PEEK(1047) OR 64:SCREEN
      1,0:CLS:RANDOMIZE TIMER:CO
      LOR ,0
IL 60 FOR A=1 TO 50:W=RND*7+1:X=
      RND*290+10:Y=RND*150+20:DR
      AW "C3BM=X;,=Y; XW$(W);":N
      EXT A
GF 70 LOCATE 5,11:PRINT "Lumpies
       of Lotis IV":LOCATE 18,12
      :PRINT "one moment please"
CG B0 DEF FNZ(PL)=INT(ABS(Z(X+XP
      (PL,DIR),Y+YP(PL,DIR),LEV)
      )):DEF FNZ1(PL)=ABS(Z(X+XP
      (PL,DIR),Y+YP(PL,DIR),LEV)
      )
BN 90 LEVELS=2: ' This sets the
      number of levels
MI 100 DIM Z(42,25,LEVELS),XP(10
      ,4),YP(10,4)
```

```
LJ 110 YS=20:YWP=0:YWPN=0:DIR=3:
       LEV=1:TDGW=1:TDGX=1:HDME=
       0
PO 120 FDR A=1 TD 4:READ DR(A):N
       EXT A:FDR A=1 TD 4:FDR B=
       1 TO 10:READ XP(B,A):NEXT
        B,A:FDR A=1 TD 4:FDR B=1
        TO 10:READ YP(B,A):NEXT
       B,A
CC 130 FDR A=0 TD 7:READ WP$(A):
       NEXT A:FDR A=1 TD 4:READ
       CDMM$(A):NEXT A:FDR C=1 T
       D LEVELS:FDR A=2 TO 23:RE
       AD A$:FDR B=21 TO 40:Z(B,
       A,C)=VAL(MID$(A$,B-20,1))
       :IF Z(B,A,C)=1 AND RND<.0
       23 THEN Z(B,A,C)=5
GP 140 NEXT B,A,C
JK 150 CLS:LOCATE 2,26:PRINT CHR
       $(25):LINE (0,0)-(15B,12B
       ),1,B:LINE (1,1)-(157,127
       ),1,B:LDCATE 1,2B:PRINT "
       Level 1":DEF SEG:POKE &H4
       E,1:LOCATE 24,25:PRINT "2
       0 Strength";:PDKE &H4E,3:
       LDCATE 25,27:PRINT "#0 No
       ne";
BA 160 X=26:Y=2:GOTD 410
PG 170 XO=X:YO=Y
EJ 1B0 X=XD:Y=YO:DEF SEG=0:PDKE
       1050,PEEK(1052)
KA 190 A$=INKEY$:IF A$="" THEN 1
       90
JP 200 A$=RIGHT$(A$,1):IF A$<>"H
       " AND A$<>"P" AND A$<>"K"
        ANO A$<>"M" AND A$<>"C"
       AND A$<>"T" AND A$<>"B" A
       ND A$<>"W" AND A$<>"U" AN
       D A$<>"O" AND A$<>"X" AND
        A$<>"S" THEN 190
FD 210 IF A$="S" THEN 1110
GI 220 IF INT(ABS(Z(X,Y,LEV)))=3
        AND A$="T" THEN SWAP YWP
       N,NWPN:SWAP YWP,NWP:LDCAT
       E 25,21:PRINT STRING$(1B,
       32);:LDCATE 25,2B-LEN(WP$
       (YWP))/2:PRINT "#"RIGHT$(
       STR$(YWPN),1)" ";WP$(YWP)
       ;:IF NWPN=0 THEN Z(X,Y,LE
       V)=-1 ELSE Z(X,Y,LEV)=-3-
       (NWP*.1)-(NWPN*.01)
LH 230 IF FNZ1(5)=2 AND A$="B" T
       HEN LDCATE 1B,4:PRINT " D
       oor Broken ":Z(X+XP(5,DIR
       ),Y+YP(5,DIR),LEV)=-2.1:F
       OR A=15 TO 1 STEP -1:SOUN
       D 60,.7:SOUNO 32767,.15+A
       *.1:NEXT A:IF TOGW=-1 THE
       N 170 ELSE 410
NN 240 IF A$="W" THEN TOGW=-TDGW
       :LOCATE 19,5:IF TOGW=1 TH
       EN PRINT " Window On ":GO
       TO 410 ELSE PRINT " Windo
       w Off ":GDTO 170
LF 250 IF A$="X" THEN TDGX=-TDGX
       :LDCATE 19,5:IF TOGX=1 TH
       EN PRINT "  Map Dn   ":GD
       SUB 960 ELSE PRINT "  Map
        Off   ":LINE (159,B)-(32
       0,1B3),0,BF:GOTO 170
IF 260 IF ABS(Z(X,Y LEV-1))=4 AN
       O A$="U" ANO LEV<>1 THEN
       LEV=LEV-1:FOR A=1 TO 30:S
       OUNO A*60,4:NEXT A:GOTO 9
       60
GI 270 IF ABS(Z(X,Y,LEV))=4 AND
       A$="D" ANO LEV<>LEVELS TH
       EN LEV=LEV+1:FOR A=30 TO
       1 STEP -1:SOUNO A*60,4:NE
       XT A:GOTO 960
MH 280 IF A$="P" THEN DIR=DIR+2:
       IF OIR>4 THEN DIR=OIR-4
ML 290 IF A$="H" THEN IF DIR=1 A
       ND Y>2 THEN Y=Y-1 ELSE IF
        DIR=2 AND X<40 THEN X=X+
       1 ELSE IF DIR=3 AND Y<23
       THEN Y=Y+1 ELSE IF DIR=4
       AND X>21 THEN X=X-1
GE 300 IF A$="M" THEN DIR=DIR+1:
       IF DIR>4 THEN DIR=1
GN 310 IF A$="K" THEN DIR=DIR-1:
       IF DIR<1 THEN OIR=4
JI 320 IF Z(X,Y,LEV)=0 DR Z(X,Y,
       LEV)=-2 THEN SDUND 60,.1:
       GDTD 1B0
JN 330 LINE(0,135)-(159,200),0,B
       F
EE 340 FOR A=-1 TD 1:FDR B=-1 TO
       1
PN 350 IF A+Y=1 DR A+Y=24 OR B+X
       =20 OR B+X=41 THEN 3B0
KD 360 IF Z(X+B,Y+A,LEV)=0 THEN
       3B0
HE 370 LOCATE Y+A,X+B:PRINT CHR$
       (B*-(TOGX=1));:IF Z(X+B,Y
       +A,LEV)>0 THEN Z(X+B,Y+A,
       LEV)=-Z(X+B,Y+A,LEV)
IO 3B0 NEXT B,A
GK 390 LDCATE YD,XD:PRINT CHR$(B
       *-(TOGX=1));:LDCATE Y,X:P
       RINT CHR$(OR(DIR)*-(TOGX=
       1));
NH 400 IF TOGW=-1 THEN 5B0
ML 410 LINE(2,2)-(156,126),0,BF:
       LINE(0,116)-(32,95),1:LIN
       E-(126,95),1:LINE-(15B,11
       6),1:LINE(0,10)-(32,32),1
       :LINE-(126,32),1:LINE-(15
       B,10),1
IB 420 IF FNZ(1)=0 DR FNZ(1)=2 T
       HEN LINE(32,32)-(32,95),1
       :PAINT(2,12),3,1:IF FNZ(1
       )=2 THEN W=FNZ1(1)*10-20:
       ORAW "XD1$(W);":GOTO 460
       ELSE 460
BG 430 IF FNZ(4)=0 OR FNZ(4)=2 T
       HEN LINE(0,32)-(32,95),1,
       B:LINE(2,33)-(31,94),3,BF
       :GOTO 460 ELSE LINE(0,43)
       -(20,49),1:LINE(0,B2)-(20
       ,77),1
FJ 440 LINE(0,32)-(32,32),1:LINE
       (0,95)-(32,95),1:IF FNZ(3
       )=0 OR FNZ(3)=2 THEN LINE
       (20,49)-(20,77),1:PAINT(2
       ,45),3,1
FJ 450 IF FNZ(B)=0 DR FNZ(B)=2 T
       HEN LINE(20,49)-(32,77),1
       ,B:LINE(21,50)-(31,76),3,
       BF
DN 460 IF FNZ(2)=0 DR FNZ(2)=2 T
       HEN LINE(126,32)-(126,95)
       ,1:PAINT(156,12),3,1:IF F
       NZ(2)=2 THEN W=FNZ1(2)*10
       -20:ORAW "XO2$(W);":GOTO
       500 ELSE 500
EI 470 IF FNZ(6)=0 DR FNZ(6)=2 T
       HEN LINE(15B,32)-(126,95)
       ,1,B:LINE(156,33)-(127,94
       ),3,BF:GOTO 500 ELSE LINE
       (15B,43)-(13B,49),1:LINE(
       15B,B2)-(13B,77),1
IB 4B0 LINE(15B,32)-(126,32),1:L
       INE(15B,95)-(126,95),1:IF
        FNZ(7)=0 OR FNZ(7)=2 THE
       N LINE(13B,49)-(13B,77),1
       :PAINT(156,45),3,1
FC 490 IF FNZ(10)=0 OR FNZ(10)=2
        THEN LINE(13B,49)-(126,7
       7),1,B:LINE(137,50)-(127,
       76),3,BF
GP 500 IF FNZ(5)=0 OR FNZ(5)=2 T
       HEN LINE(32,32)-(126,95),
       1,B:LINE(33,33)-(125,94),
       3,BF:IF FNZ(5)=2 THEN W=F
       NZ1(5)*10-20:ORAW "XO5$(W
       );":GDTD 5B0 ELSE 5B0 ELS
       E LINE(32,32)-(5B,49),1:L
       INE(32,95)-(5B,77),1:LINE
       (126,32)-(100,49),1:LINE(
       126,95)-(100,77),1
QK 510 IF FNZ(4)=0 DR FNZ(4)=2 T
       HEN LINE(5B,49)-(5B,77),1
       :PAINT(33,34),3,1:IF FNZ(
       4)=2 THEN W=FNZ1(4)*10-20
       :DRAW "XD4$(W);":GDTD 540
        ELSE 540
EN 520 IF FNZ(B)=0 DR FNZ(B)=2 T
       HEN LINE(32,49)-(5B,77),1
       ,B:LINE(33,50)-(57,76),3,
       BF:IF FNZ(1)<>0 AND FNZ(1
       )<>2 THEN LINE(32,49)-(32
       ,77),3
MP 530 IF FNZ(B)=2 THEN W=FNZ1(B
       )*10-20:ORAW "XDB$(W);"
HN 540 IF FNZ(6)=0 DR FNZ(6)=2 T
       HEN LINE(100,49)-(100,77)
       ,1:PAINT(125,34),3,1:IF F
       NZ(6)=2 THEN W=FNZ1(6)*10
       -20:DRAW "XO6$(W);":GOTO
       570 ELSE 570
CK 550 IF FNZ(10)=0 DR FNZ(10)=2
        THEN LINE(126,49)-(100,7
       7),1,B:LINE(125,50)-(101,
       76),3,BF:IF FNZ(2)<>0 AND
        FNZ(2)<>2 THEN LINE(126,
       49)-(126,77),3
NG 560 IF FNZ(10)=2 THEN W=FNZ1(
       10)*10-20:DRAW "XD10$(W);
       "
JB 570 IF FNZ(9)=0 DR FNZ(9)=2 T
       HEN LINE(5B,49)-(100,77),
       1,B:LINE(59,50)-(99,76),3
       ,BF:IF FNZ(9)=2 THEN W=FN
       Z1(9)*10-20:ORAW "XD9$(W)
       ;"
OF 5B0 IF FNZ1(5)=2 THEN LOCATE
       1B,4:PRINT "(B)reak Door"
FG 590 IF INT(ABS(Z(X,Y,LEV)))=3
        THEN NWP=VAL(MIO$(STR$(Z
       (X,Y,LEV)),4,1)):NWPN=VAL
       (MIO$(STR$(Z(X,Y,LEV)),5,
       1)):ORAW "BM75,106 XW$(NW
       P);":LOCATE 21,6:PRINT "(
       T)ake ?":LOCATE 22,B-LEN(
       WP$(NWP))/2:PRINT "#"RIGH
       T$(STR$(NWPN),1)" ";WP$(N
       WP)
PH 600 IF Z(X,Y,LEV)=-4 OR ABS(Z
       (X,Y,LEV-1))=4 THEN GOSUB
        910
DH 610 IF Z(X,Y,LEV)<=-5 THEN DN
        INT(ABS(Z(X,Y,LEV)))-4 G
       OTO 630,B30,B70,1000 ELSE
       170
PB 620 ' ALIEN
AC 630 IF INT(Z(X,Y,LEV))<>Z(X,Y
       ,LEV) THEN WP=VAL(MID$(ST
       R$(Z(X,Y,LEV)),4,1)):WPN=
       VAL(MID$(STR$(Z(X,Y,LEV))
       ,5,1)):CL=VAL(MIO$(STR$(Z
       (X,Y,LEV)),6,1)):GOTO 650
FL 640 IF RND>.85 THEN Z(X,Y,LEV
       )=-1:GOTO 170 ELSE CL=INT
       (RND*2)*2+1:WP=INT(RNO*7)
       +1:WPN=INT(RND*(9/LEVELS)
       +1+(9*LEV-9)/LEVELS)
QI 650 IF TDGW=-1 THEN 6B0
KA 660 DRAW "C2BM69,100R5NU12R3U
       12R2012R3NR5U12M+10,-20FB
       E2H9M+4,-BL3BM+4,+BL1103R
       12M+10,+20BU26P0,2P=CL;,2
       BL5C0R1BBU20C2G5BLBH5":CI
       RCLE(70,52),5,2:PAINT(70,
       52),0,2:CIRCLE(B5,52),5,2
       :PAINT(B5,52),0,2:LINE(70
       ,52)-(72,54),3,BF:LINE(B5
       ,52)-(83,54),3,BF
HJ 670 DRAW "BM55,67 XW$(WP);"
```

```
HO 6BØ LOCATE 1B,3:PRINT "A lump
      y with a":LOCATE 19,9-LEN
      (WP$(WP))/2:PRINT "#"RIGH
      T$(STR$(WPN),1)" ";WP$(WP
      ):LDCATE 21,2:PRINT "(F)i
      ght or (R)un":HT=Ø
OE 69Ø DEF SEG=Ø:PDKE 1050,PEEK(
      1052)
FP 7ØØ A$=INKEY$:IF A$="R" THEN
      LDCATE Y,X:PRINT CHR$(8*-
      (TDGX=1));:LDCATE YD,XD:P
      RINT CHR$(DR(DIR)*-(TDGX=
      1));:A=5:GDTO 79Ø ELSE IF
       A$<>"F" THEN 7ØØ
KK 71Ø IF RND*1ØØ+1>5Ø+(WPN-YWPN
      )*5 THEN LOCATE 23,5:PRIN
      T "You hit    ":HT=HT+INT(
      RND*2)+1:IF HT>4 THEN 75Ø
       ELSE DEF SEG:POKE &H4E,2
      :LOCATE 25,2:PRINT CDMM$(
      HT);:POKE &H4E,3 ELSE LDC
      ATE 23,5:PRINT "You misse
      d"
JB 72Ø IF RND*1ØØ+1>5Ø+(YWPN-WPN
      )*5 THEN LOCATE 24,5:PRIN
      T "He hit    ";:YS=YS-1:DE
      F SEG:PDKE &H4E,1:LOCATE
      24,24:PRINT YS;"Strength
      ";:POKE &H4E,3 ELSE LDCAT
      E 24,5:PRINT "He missed";
FC 73Ø IF YS<=Ø THEN 1110
MH 74Ø IF RND<.Ø75 AND YWPN<>Ø T
      HEN YWP=Ø:YWPN=Ø:DEF SEG:
      POKE &H4E,2:LOCATE 25,23:
      PRINT "     #Ø None    ";:P
      OKE &H4E,3:GOTO 7ØØ ELSE
      7ØØ
EJ 75Ø LINE(Ø,135)-(159,2ØØ),Ø,B
      F:IF TOGW=1 THEN DRAW "BM
      66,52C1R8BH4D88R15U88G4R8
      "
OL 76Ø LOCATE 18,5:PRINT "He has
       fled":LT=LT+1:LOCATE 2Ø,
      3:PRINT "Do you want his"
      :LOCATE 21,8-LEN(WP$(WP))
      /2:PRINT "#"RIGHT$(STR$(W
      PN),1)" ";WP$(WP):LOCATE
      22,3:PRINT "weapon (Y/N)
      ?"
QP 77Ø A=3:A$=INKEY$:IF A$<>"N"
      AND A$<>"Y" THEN 77Ø
EF 78Ø IF A$="Y" THEN SWAP YWP,W
      P:SWAP YWPN,WPN:LOCATE 25
      ,21:PRINT STRING$(18,32);
      :LOCATE 25,28-LEN(WP$(YWP
      ))/2:PRINT "#"RIGHT$(STR$
      (YWPN),1)" ";WP$(YWP);
JA 79Ø IF WPN=Ø THEN Z(X,Y,LEV)=
      -1 ELSE Z(X,Y,LEV)=-A-(WP
      *.1)-(WPN*.Ø1)-(CL*.ØØ1)
PB 8ØØ LINE (Ø,135)-(159,2ØØ),Ø,
      BF:IF A=5 THEN X=XO:Y=YO
OM 81Ø IF TOGW=-1 THEN 17Ø ELSE
      41Ø
AA 82Ø ' FOOD
QJ 83Ø LOCATE 21,4:PRINT "You fo
      und food":FO=INT(RND*6+1)
      :LOCATE 23,3:PRINT "worth
      ";FO;"strength":YS=YS+FO:
      DEF SEG:POKE &H4E,1:LOCAT
      E 24,24:PRINT YS;"Strengt
      h";:POKE &H4E,3
BF 84Ø IF TOGW=1 THEN FOR A=1 TO
       FO:LINE (RND*2Ø+7Ø,RND*1
      Ø+1Ø5)-STEP(4,4),RND*2+1,
      8:NEXT A
LP 85Ø Z(X,Y,LEV)=-1:GOTO 17Ø
NA 86Ø ' PRISONER
BL 87Ø IF TOGW=-1 THEN 89Ø ELSE
      DRAW "C28M7Ø,12ØR3U2ØNU15
      M-3,-18R6U2R3D2R6M-3,+18U
      15D35R3L6U17L3D17L28EBU23
      PØ,2":PAINT (8Ø,111),CHR$
      (&HØ)+CHR$(&HØ)+CHR$(&HFF
      )+CHR$(&HFF),2:CIRCLE (7B
      ,76),5,2
HF 88Ø PAINT (78,77),Ø,2:PSET (7
      6,75),3:PSET (BØ,75),3:DR
      AW "C2BM143,1ØBM-15,-1ØNE
      BR1ØM+17,+1ØL11BE1P1,2C2E
      1Ø":LINE (77,7B)-(79,7B),
      3
AE 89Ø LOCATE 19,1:PRINT "You fr
      eed a prisoner":Z(X,Y,LEV
      )=-1:PF=PF+1:GOTO 17Ø
NE 9ØØ ' LADDER  SUBRDUTINE #1
DO 91Ø IF A8S(Z(X,Y,LEV))=4 AND
      LEV<>LEVELS AND TOGW=1 TH
      EN CIRCLE (79,115),3Ø,1,,
      ,2/8:LINE (7Ø,93)-(7Ø,121
      ),2:LINE (8B,93)-(BB,121)
      ,2:FDR A=99 TO 122 STEP 1
      Ø:LINE (7Ø,A)-(BB,A),2:NE
      XT A
QN 92Ø IF A8S(Z(X,Y,LEV))=4 AND
      LEV<>LEVELS THEN LOCATE 2
      Ø,3:PRINT "(D)own Ladder"
      :RETURN
CO 93Ø IF A8S(Z(X,Y,LEV-1))=4 AN
      D LEV>1 AND TOGW=1 THEN C
      IRCLE (79,13),3Ø,1,,,2/B:
      LINE (7Ø,7)-(7Ø,115),2:LI
      NE (BB,7)-(BB,115),2:FDR
      A=9 TO 115 STEP 1Ø:LINE (
      7Ø,A)-(BB,A),2:NEXT A
DO 94Ø IF A8S(Z(X,Y,LEV-1))=4 AN
      D LEV>1 THEN LOCATE 22,4:
      PRINT "(U)p Ladder":RETUR
      N
LE 95Ø ' LADDER SU8ROUTINE #2
MJ 96Ø LINE (159,Ø)-(32Ø,183),Ø,
      8F:LOCATE 1,28:PRINT "Lev
      el";LEV:LOCATE 24,2:PRINT
       "One Moment Please";:IF
      INT(Z(X,Y,LEV))=5 THEN Z(
      X,Y,LEV)=1
EJ 97Ø FOR A=2 TO 23:FOR 8=21 TO
       4Ø:IF Z(8,A,LEV)<Ø THEN
      LOCATE A,8:PRINT CHR$(8*-
      (TOGX=1));
IG 98Ø NEXT B,A:LINE (Ø,135)-(15
      9,2ØØ),Ø,BF:GOTO 34Ø
BO 99Ø ' COMMUNICATIONS ROOM
HB 1ØØØ LOCATE 18,1:PRINT."Commu
      nications Room":IF HOME=
      Ø THEN LOCATE 2Ø,4:PRINT
       "(C)all Home":LOCATE 22
      ,4:PRINT "(I)gnore":LOCA
      TE 24,2:PRINT "Status to
       go home";
CC 1Ø1Ø IF TOGW=1 THEN LINE (4Ø,
      85)-(118,1Ø5),2,8:PAINT
      (41,1Ø2),3,2:FOR A=44 TO
       114 STEP 18:LINE (A,87)
      -(A+16,1Ø3),2,B:NEXT A:L
      INE (4Ø,85)-(42,8Ø),2:LI
      NE (118,85)-(116,8Ø),2:L
      INE (42,75) (116,8Ø),2,B
      :PAINT (43,82),3,2:PAINT
       (43,77),3,2
BB 1Ø2Ø IF TOGW=1 THEN FOR A=45
       TO 113 STEP 2:LINE (A,77
      )-(A+1,78),RND*2+1,8F:NE
      XT A:LINE (64,5Ø)-(93,67
      ),2,B:CIRCLE (79,58),9,2
      :PSET (79,58),2
BL 1Ø3Ø A$=INKEY$:A=A-2Ø:IF A<=Ø
       THEN A=36Ø:SOUND 1ØØØ,2
JK 1Ø4Ø IF TOGW=1 THEN DRAW "C3N
      U5TA=A;C2NU5;"
JC 1Ø5Ø IF A$="C" AND HOME=Ø THE
      N HOME=1:GOTO 1Ø8Ø
BB 1Ø6Ø IF (A$="I" AND HOME=Ø) O
      R (A$<>"" AND HOME=1) TH
      EN 1Ø8Ø
KC 1Ø7Ø GOTO 1Ø3Ø
OK 1Ø8Ø IF TOGW=1 THEN DRAW "TAØ
      ;"
AE 1Ø9Ø LOCATE Y,X:PRINT CHR$(8*
      -(TDGX=1));:LDCATE YD,XD
      :PRINT CHR$(DR(DIR)*-(TD
      GX=1));:X=XO:Y=YD:GDTD 3
      3Ø
OA 11ØØ ' STATUS AND END
EB 1110 LINE (37,3Ø)-(261,97),Ø,
      BF:LINE (3B,31)-(260,96)
      ,2,B
EA 112Ø LDCATE 5,13:PRINT "Playe
      r Status":LOCATE 7,6:PRI
      NT "Prisoners freed :";P
      F:LDCATE 8,6:PRINT "Lump
      ies defeated :";LT:LDCAT
      E 1Ø,11:PRINT "Dne momen
      t please":USEEN=Ø:FDR C=
      1 TD LEVELS:FOR A=2 TD 2
      3:FDR B=21 TO 4Ø:IF Z(B,
      A,C)>Ø THEN USEEN=USEEN+
      1
BH 113Ø NEXT 8,A,C:LOCATE 9,6:PR
      INT "Units not seen :";U
      SEEN
EO 114Ø LOCATE 1Ø,6:PRINT "Commu
      nications Room ";:IF HDM
      E THEN PRINT "seen" ELSE
       PRINT "not seen"
IP 115Ø IF YS<=Ø THEN LOCATE 11,
      12:PRINT "You are defeat
      ed.":END
OM 116Ø IF HOME THEN LOCATE 12,1
      1:PRINT "Return home (Y/
      N)?" ELSE LOCATE 12,8:PR
      INT "Hit any key to cont
      inue":DEF SEG=Ø:POKE 105
      Ø,PEEK(1052)
JA 117Ø A$=INKEY$:IF A$="Y" ANO
      HOME=1 THEN CLS:LOCATE 1
      1,8:PRINT "You return ho
      me safely":END
KF 118Ø IF A$="N" ANO HOME=1 OR
      A$<>"" ANO HOME=Ø THEN 1
      19Ø ELSE 117Ø
AA 119Ø LINE (38,31)-(26Ø,96),Ø,
      8F:LINE (Ø,Ø)-(158,128),
      1,8:LINE (1,1)-(157,127)
      ,1,8:GOTO 96Ø
LC 12ØØ ' DIRECTION DATA
EO 1211 DATA 24,26,25,27
OF 1220 ' X DATA
MC 1230 DATA -1,1,-2,-1,Ø,1,2,-1
      ,Ø,1
JK 1240 DATA Ø,Ø,1,1,1,1,1,2,2,2
LP 1250 DATA 1,-1,2,1,Ø,-1,-2,1,
      Ø,-1
OF 1260 DATA Ø,Ø,-1,-1,-1,-1,-1,
      -2,-2,-2
QM 1270 ' Y DATA
EL 1280 DATA Ø,Ø,-1,-1,-1,-1,-1,
      -2,-2,-2
ME 1290 DATA -1,1,-2,-1,Ø,1,2,-1
      ,Ø,1
IA 13ØØ DATA Ø,Ø,1,1,1,1,1,2,2,2
KF 1310 DATA 1,-1,2,1,Ø,-1,-2,1,
      Ø,-1
LK 1320 ' WEAPONS
PF 1330 DATA None,Briefcase,5/16
       Wrench,Gun,Arrow,Yo-yo,
      Refreshment,Bomb
OE 1340 ' COMMENTS
PQ 1350 DATA "   He's worried
      "," He's nervous   "," 
      He's a little sore","He'
      s getting weak "
FK 2ØØØ ' LEVEL 1
JM 2Ø1Ø DATA 125101Ø615211111125
      6
MC 2Ø2Ø DATA 1Ø11Ø1Ø111Ø1ØØ2Ø1ØØ
      Ø
FA 2Ø3Ø DATA 1Ø612125110106501251
```

```
EF 2040 DATA 1000010000010020101
        6
BL 2050 DATA 1111111111110110100
        0
BH 2060 DATA 2000010000200152125
        1
HK 2070 DATA 1111012501110100101
        1
DI 2080 DATA 1111010605150601106
        1
ID 2090 DATA 0000010002020001000
        0
IE 2100 DATA 1521110111011101111
        1
NN 2110 DATA 6101000100000100010
        2
NA 2120 DATA 0001072127072127010
        5
HM 2130 DATA 1111000100000100010
        0
II 2140 DATA 1000072127072127011
        1
EB 2150 DATA 1256000200000200010
        1
CB 2160 DATA 1065210111511101110
        1
ID 2170 DATA 1000010000200001000
        1
PN 2180 DATA 1111110401510111111
        1
GF 2190 DATA 0000100506110100002
        0
DD 2200 DATA 1111102500000101605
        1
NJ 2210 DATA 2020111001111125101
        1
PM 2220 DATA 7070001111000001101
        6
IF 3000 ' LEVEL 2 DATA
KM 3010 DATA 1100111110000451101
        1
JB 3020 DATA 1160200011110011125
        6
QP 3030 DATA 1110511000011011100
        0
BB 3040 DATA 1150111211011011106
        1
MI 3050 DATA 0020000011011005101
        5
DM 3060 DATA 1112111015211112000
        2
NE 3070 DATA 2010111001010000011
        1
LP 3080 DATA 1210111200010111051
        1
QI 3090 DATA 1000000111110111020
        0
KK 3100 DATA 1011160000010511011
        1
ND 3110 DATA 1000110111010200010
        1
EM 3120 DATA 1110110111011111110
        1
PC 3130 DATA 0010050202001000000
        2
JB 3140 DATA 8011212101101270725
        1
CD 3150 DATA 2001000125101000001
        1
MC 3160 DATA 1111111101101270721
        1
IF 3170 DATA 0001000200001000002
        0
IE 3180 DATA 0721270101521251521
        0
PM 3190 DATA 0002000001101011102
        0
HK 3200 DATA 1607015061101000005
        1
GP 3210 DATA 1100011000001251011
        1
EG 3220 DATA 1521211211111011061
        1                        ©
```

Pyramid Power

For The Amiga

Mike Lightstone

This colorful action game, originally written for the IBM PC/PCjr, runs on any Amiga computer with 512K memory. A joystick is required.

The object of "Pyramid Power" is to fill in all the cubes that make up the pyramid by jumping onto each one—while evading some hazardous pursuers. The pyramid is 6 cubes wide by 6 cubes high. If you succeed in filling all 21 cubes, you advance to a new level.

Your pursuers consist of a bouncing rock and a pesky buglike creature. The rock comes bouncing down randomly from the top of the screen, starting over again every time it reaches the bottom of the pyramid. The creature is a little smarter. It constantly follows your every move as you jump from cube to cube. If your player collides with either one, the game ends.

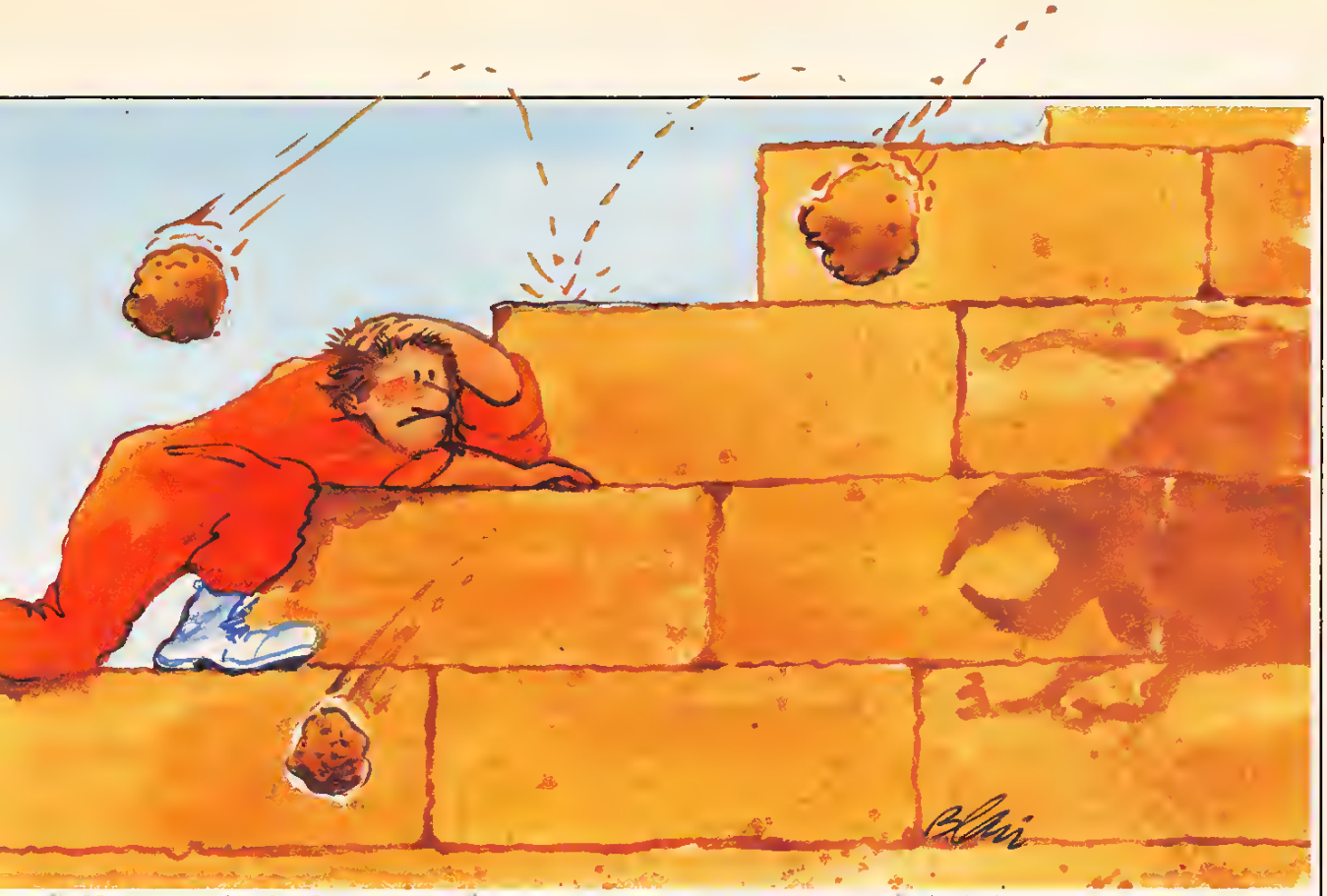
You can also lose the game by jumping in the wrong direction and falling off the edge of the pyramid. This happens frequently when you're fleeing in panic from the tumbling rock or nasty creature.

Type in the program and save a copy before you run it. The small ← character indicates where each program line ends. Don't try to type this character—we deliberately chose one that's not on the Amiga keyboard. The ← character merely shows where you should press RETURN (or move the cursor off the line) to enter one program line and start another. The joystick controls your movement. Plug the joystick into the port next to the mouse port (do not unplug the mouse).

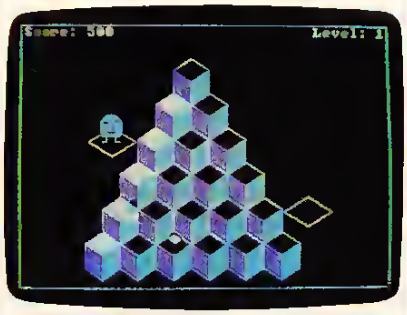
Two Escape Routes

To make things a little easier, there are two special ways you can avoid your pursuers. A pair of elevators flanking the base of the pyramid stand ready to transport you at any time to the apex. To get on the elevator, you have to jump upward from the cubes at the bottom corners of the pyramid. Just get on the elevator and ride to the top. You can use an elevator as often as you like. But be careful not to miss when you jump, or you'll fall off the edge and lose the game.

The scoring system is pretty simple. Jumping on an empty cube is worth 100 points times the number of the level you're on, and elevator rides subtract 100 points times your level number. In other words, cubes are worth 100 points on level 1, 200 points on level 2, and so on. Elevator rides subtract



100 points on level 1, 200 points on level 2, and so on. Advancing to a new level earns a bonus of 1000 points. The program keeps track of your current score and high score, but the high score may reflect the points you gained before your last elevator ride. Finally, Pyramid Power gets harder at the third level and again at the eighth.



"Pyramid Power" for the 512K Amiga features colorful action on a three-dimensional playing field.

Pyramid Power

```
'
setup:'
CLEAR ,25000'
CLEAR ,65536&'
SCREEN 1,320,200,2,1'
WINDOW 1,"",(0,0)-(311,25),16,1'
WINDOW 2,"",(0,0)-(311,185),16,1
'
WINDOW OUTPUT 2'
CLS'
PALETTE 0,0,0,0'
PALETTE 3,1,1,1'
PALETTE 2,.8,0,.93'
PALETTE 1,0,.93,.87'
'
DIM b(12,7),c(80),f(80)'
sp=.25:lev=1:hs=0:RANDOMIZE TIME
R'
CLS:LOCATE 4,8:COLOR 2,0'
PRINT "P Y R A M I D - P O W E R
"'
COLOR 3,0:LOCATE 10,1:GOSUB play
er'
PRINT "The object of the game is
to change the"'
PRINT "color of all the cubes wh
ile avoiding"'
PRINT "the bouncing rocks and cr
eatures. Use"'
PRINT "joystick #2 to move. For
a fast trip"'
PRINT "up, take the elevators. B
e careful not"'
PRINT "to fall off the edges."'
GOSUB creatureshape'
GOSUB button'
'
restart:'
CLS:LOCATE 4,10:PRINT"Player:":P
UT(150,20),a'
LOCATE 8,10:PRINT"Creature:":PUT
(155,50),q'
LOCATE 12,10:PRINT"Rock:":CIRCLE
(158,92),5,3'
PAINT (158,92),3,3:LOCATE 16,10'
PRINT"Elevator:":LINE(165,123)-(
185,112),3'
LINE-(205,123),3:LINE-(185,134),
3:LINE-(165,123),3'
GET(151,87)-(164,97),c:GET(164,1
11)-(206,135),f'
GOSUB button'
'
readdata:'
RESTORE:FOR z=1 TO 7:FOR z1=0 TO
12'
READ b(z1,z):NEXT z1,z'
'
start:'
CLS:z1=0:FOR z=190 TO 40 STEP -2
6'
FOR z3=70+z1*15 TO 220-z1*15 STE
P 30'
LINE (z3,z)-(z3,z-18),3:LINE-(z3
+15,z-27),3'
LINE-(z3,z-36),3:LINE-(z3-15,z-2
7),3:LINE-(z3,z-18),3'
LINE-(z3,z),3:LINE-(z3+15,z-9),3
:LINE-(z3+15,z-27),3'
LINE(z3,z)-(z3-15,z-9),3:LINE-(z
3-15,z-27),3'
PAINT(z3+7,z-9),1,3:PAINT(z3-7,z
-9),2,3'
NEXT:z1=z1+1:NEXT'
'
x=6:y=1'
GOSUB playerxy'
j=7:k=2:j1=.5:k1=-.5:k2=1.5'
PUT(49+j*15,23+(k-1)*26),c'
g=6:h=5:g1=0:h1=0'
PUT(50+g*15,13+(h-1)*26),q'
f1=11:f2=5'
PUT(f1*15+56,5*26-3),f'
PUT(27,5*26-3),f'
checksquares:'
IF x<>INT(x) OR y<>INT(y) THEN'
GOSUB move'
IF k1=1 THEN gameover'
END IF'
IF sq=21 THEN finished'
IF x<>INT(x) OR y<>INT(y) THEN r
ock'
LOCATE 1,1:PRINT "Score:"score'
LOCATE 1,32:PRINT "Level:"lev'
IF STICK(2)<>0 AND STICK(3)<>0 T
HEN'
GOSUB move'
IF k1=1 THEN gameover '
END IF'
'
rock:'
PUT(49+j*15,23+(k-1)*26),c'
IF k=INT(k) AND k1=1.5 AND j=INT
(j) THEN'
j1=INT(3*RND(1))-1:j1=j1/2'
k1=-.5:k2=k-.5:SOUND 126,2'
```

```
END IF
IF jl=0 THEN jl=-.5
IF j=x AND k=y THEN
GOSUB creaturerock
IF kl=1 THEN gameover
END IF
j=j+jl:k=k+kl:IF k=k2 THEN kl=1.
5
IF k=8 THEN k=1:j=6:k2=.5
PUT(49+j*15,23+(k-1)*26),c

creature:
PUT(50+g*15,13+(h-1)*26),q
IF g<>INT(g) OR h<>INT(h) THEN c
reaturecont
IF g<x THEN gl=sp
IF g>x THEN gl=-sp
IF h>y THEN hl=-sp
IF h<y THEN hl=sp
IF h=y OR g=x THEN gl=0:hl=0
IF g=x AND h<y THEN
hl=sp:gl=(INT(3*RND(1))-1)*sp
IF gl=0 THEN gl=sp
END IF
IF g=x AND h>y THEN
hl=-sp:gl=(INT(3*RND(1))-1)*sp
IF gl=0 THEN gl=-sp
END IF
IF h=y AND g<x THEN
gl=sp:hl=(INT(3*RND(1))-1)*sp
IF hl=0 OR h+hl>6 THEN hl=-sp
END IF
IF h=y AND g>x THEN
gl=-sp:hl=(INT(3*RND(1))-1)*sp
IF hl=0 OR h+hl>6 THEN hl=-sp
END IF
creaturecont:
g=g+gl:h=h+hl
PUT(50+g*15,13+(h-1)*26),q
IF x=g AND y=h THEN
GOSUB creaturerock
IF kl=1 THEN gameover
END IF
GOTO checksquares

move:
GOSUB playerxy
IF x<>INT(x) OR y<>INT(y) THEN m
ovecont
IF STICK(2)=1 AND STICK(3)=1 THE
N xl=.5:yl=.5
IF STICK(2)=-1 AND STICK(3)=1 TH
EN xl=-.5:yl=.5
IF STICK(2)=1 AND STICK(3)=-1 TH
EN xl=.5:yl=-.5
IF STICK(2)=-1 AND STICK(3)=-1 T
HEN xl=-.5:yl=-.5
movecont:
x=x+xl:y=y+yl
IF x=INT(x) OR y=INT(y) THEN xl=
0:yl=0
IF x=INT(x) THEN SOUND 880,1 ELS
E SOUND 440,2
IF x=INT(x) AND b(x,y)=1 THEN
GOSUB rocky:PAINT(47+x*15,30+(y-
1)*27),3,3
sq=sq+1:b(x,y)=0:GOSUB rocky
nn=1:GOSUB scorecalc
END IF
IF sq=21 THEN RETURN
IF x=INT(x) AND y=INT(y) AND b(x
,y)=4 THEN
GOSUB rightelevator:nn=-1:GOSUB
scorecalc
END IF
IF x=INT(x) AND y=INT(y) AND b(x
,y)=5 THEN
GOSUB leftelevator:nn=-1:GOSUB s
corecalc
END IF
IF x=INT(x) AND y=INT(y) AND b(x
,y)=3 THEN
GOSUB edge:IF kl=1 THEN RETURN
END IF
IF (j=x AND k=y) OR (g=x AND h=y
) THEN
GOSUB creaturerock:IF kl=1 THEN
RETURN
END IF
IF y<1 THEN y=1:x=6:xl=0:yl=0
GOSUB playerxy
RETURN

rocky:
PUT(49+j*15,23+(k-1)*26),c
PUT(50+g*15,13+(h-1)*26),q
RETURN

rightelevator:
PUT(f1*15+56,5*26-3),f
z1=5:FOR z=11 TO 7 STEP-.25
GOSUB playerzz1
PUT(z*15+56,z1*26-3),f
z3=6-z1
SOUND z3*200,1
GOSUB playerzz1
PUT(z*15+56,z1*26-3),f
z1=z1-.25:NEXT
PUT(f1*15+56,5*26-3),f
x=6:y=1:RETURN

leftelevator:
PUT (27,5*26-3),f
z1=5:FOR z=0 TO 4 STEP .25
PUT(40+z*14,15+(z1-1)*26),a
PUT(z*15+27,z1*26-3),f
z3=6-z1
SOUND z3*200,1
PUT(40+z*14,15+(z1-1)*26),a
PUT(z*15+27,z1*26-3),f
z1=z1-.25:NEXT
PUT(27,5*26-3),f
x=6:y=1:RETURN

finished:
CLS:FOR Z2=3 TO 0 STEP -1
z=13:z1=10
FOR z3=1 TO 11
LINE(155-z,100-z1)-(155+z,100+z1
),Z2,b
z=z+13:z1=z1+8
SOUND z*10,2
NEXT:NEXT
score=score+lev*1000:lev=lev+1
IF lev>2 THEN sp=.5
IF lev>7 THEN sp=1
sq=0:COLOR 3,0:ts=ts+21:GOTO rea
ddata

creaturerock:
GOSUB playerxy:FOR z1=1 TO 20
x=x+SIN(z1)/5:GOSUB playerxy
SOUND 255,1
GOSUB playerxy:x=x-SIN(z1)/5
NEXT:kl=1:RETURN

edge:
z=y+.4:yl=-.2:IF x<6 THEN xl=-.1
2 ELSE xl=.12
edgecont:
IF z>6 THEN z=6
z=z+yl:x=x+xl:yl=yl+.03
PUT(52+x*14,11+(z-1)*26),a
SOUND z*1B0,1
PUT(52+x*14,11+(z-1)*26),a
IF z>6 THEN kl=1:RETURN
GOTO edgecont

gameover:
CLS:IF score>hs THEN hs=score
ts=ts+sq:LOCATE 6,9:PRINT"High S
core:"hs
LOCATE 10,9:PRINT"You scored"sco
re"points."
LOCATE 12,9:PRINT"You filled"ts"
squares."
LOCATE 14,9:PRINT"You were on le
vel "MID$(STR$(lev),2)"."
LOCATE 20,4:PRINT"Do you wish to
play again (Y/N)?"
key3:
z$=UCASE$(INKEY$)
IF z$="" OR (z$<>"Y" AND z$<>"N"
) THEN key3
IF z$="Y" THEN
score=0:lev=1:sq=0:ts=0:sp=.25:k
l=0:GOTO readdata
END IF
GOTO quit

playerxy:
PUT(52+x*14,11+(y-1)*26),a:RETUR
N

playerzz1:
PUT(64+(z+1)*14,18+(z1-1)*26),a:
RETURN

scorecalc:
score=score+nn*100*lev:RETURN

griddata:
DATA 3,3,3,3,3,3,1,3,3,3,3,3,3
DATA 3,3,3,3,3,1,0,1,3,3,3,3,3
DATA 3,3,3,3,1,0,1,0,1,3,3,3,3
DATA 3,3,3,1,0,1,0,1,0,1,3,3,3
DATA 5,3,1,0,1,0,1,0,1,0,1,3,4
DATA 3,1,0,1,0,1,0,1,0,1,0,1,3
DATA 3,3,3,3,3,3,3,3,3,3,3,3,3

quit:
WINDOW CLOSE 2
SCREEN CLOSE 1
WINDOW 1,"Pyramid Power",,31,-1
CLEAR ,25000
END

player:
DEFINT a,q:l=87:DIM a(l):RESTORE
player
FOR i=0 TO l:READ a$:a(i)=VAL("&
h"+a$):NEXT:RETURN
DATA 13,15,2,3F8,0,FFE,0,1FFF
DATA 0,3FFF,8000,7FFF,C000,E3F8,
E000,E3F8
DATA E000,FFFF,E000,FFFF,E000,FF
BF,E000,FF1F
DATA E000,FFFF,E000,FFFF,E000,FC
07,E000,FFFF
DATA E000,7FFF,C000,3FFF,8000,40
4,0,404
DATA 0,404,0,3C07,8000,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0

creatureshape:
l=87:DIM q(l):RESTORE creaturesh
ape
FOR i=0 TO l:READ a$:q(i)=VAL("&
h"+a$):NEXT:RETURN
DATA 11,15,2,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 0,0,0,0,0,0,0,0
DATA 3B0,0,FE0,0,FE0,0,47C4,0
DATA 1FF0,0,3FF8,0,3FFB,0,3FFA,0

DATA 3FFA,0,1FE0,0,2010,1C0,0,3E
0
DATA 0,7F0,0,7F0,0,7F0,0,3E0
DATA 0,23E2,0,57F5,0,8FF8,8000,1
FFC
DATA 0,1FFC,0,1FFC,0,3FFE,0,5FFD

DATA 0,9FFC,8000,9FFC,8000,8FF8,
8000,FFB
DATA 0,13E4,0,2002,0,2002,0,0

button:
LOCATE 22,6:PRINT "Hit the fire
button to play."
WHILE STRIG(3)=0:WEND
RETURN
```

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The Pawn For Atari ST

Neil Randall

What is a Roobikyoub dwarf? What is the chief product of the Farthington Real Ale company? Where is Kerovnia? Is Honest John really honest? What do gurus live on? Does alchemy work? Does a horse need legs to walk?

Truly, these are pressing issues. For time unmeasured they have obsessed us, entering our minds with the coming of the dawn and turning to dreams—sometimes nightmares—with the dark of night. But now, at long last, Firebird Licensees has provided us with a way to discover the answers.

We need only buy *The Pawn*.

The Pawn is a work of illustrated interactive fiction, a text adventure with pictures. As in most such games, you take the role of an adventurer, working your way through a fictional land and an intriguing plot, meeting other characters and figuring out what to do. You simply type in what you want your character to do, with commands such as "Look in the fountain" and "Drop everything but the pot and the trowel" (hint: one of these commands is certainly worth trying), and the computer responds accordingly. Like most text adventures, it is addicting; also like most, it is filled with frustrating, yet intriguing puzzles. In fact, it is typical in many ways. If you've played *Zork I*, you'll have no trouble getting into *The Pawn*.

In fact, *The Pawn* is quite clearly a parody of the Zorks and their ilk. At one point, the hint book even admits this, although the admission is hardly necessary. Everything in this story must be taken with a grain of salt, and at many points you'll find yourself laughing at the absurdity of it all. This is not to suggest that the Zorks were meant to be taken seriously; *The Pawn* parodies the entire genre of interactive fiction, showing us that much of it—even the serious stuff—has its shortcomings.

As far as the game itself goes, there are several notable features. The parser is good, allowing workable conversations with other characters and permitting a wide range of actions. The story itself, with its descriptions, is very funny in parts. There are puzzles, but there are no mazes. In fact, a character within the adventure is actively campaigning to eliminate the dungeons and mazes of text adventures. And, once you figure out what it is, the goal of the adventure is gripping.

Furthermore, the game has graphics—pictures to accompany the text. Some of the pictures, especially those you see first, are stunning. In the ST version, at least, they blend colors and shading superbly. The title page, copying the game box, reflects the atmosphere of the latter part of the adventure. The pictures of the grassy plain and the wilderness, with their three-dimensional perspective and fine sense of pictorial composition, are worth staring at for several minutes before you move on. But my two favorites are the stone bridge and, especially, the palace gardens. The latter uses professional shading and texture to produce a truly excellent screen display. Few of the later pictures approach the quality of this one, but one great one is enough. I wish, though, that the pictures were integral to the play of the game; Firebird might consider making them so in future games. As they stand, they are nice to have, but you don't need them to solve the adventure.

The Pawn provides excellent documentation. The main book is a 44-page story that leads up to the time of the adventure. Reading it is not necessary to playing the game, but it is well written and good fun, and it helps with the atmosphere. At the back of this book is a coded hint section, a fine idea for all text adventures. As the book tells us, the hint section "overcomes the Adventurer's usual nightmare of phoning the author, begging him for 20 minutes to impart some snippet of advice on how to kick the stuffing out of dragons, and finally being cut off halfway through the solution. It's also considerably quicker and cheaper." Strangely, though, the hints are a mixed blessing. They greatly reduce the frustration of

playing the game, but they also reduce the time it takes to solve the adventure. If you're the kind of person who wants a text adventure to occupy months of your life, tear out the hints and throw them away. Otherwise, the thing can be solved relatively quickly. Still, the hints don't give everything away.

The Pawn is a good design, and it should appeal to those who enjoyed being frustrated by *Zork*. Those who have never played a text adventure will also find it enjoyable, even though many of the jokes will not mean much. Firebird has given us a good adventure, one that bodes well for the company and for all of us adventurers. As for the answers to the questions in the first paragraph of this review, you'll have to find out for yourself. The only answer I'll provide is, "Not necessarily." The question is up to you.

The Pawn
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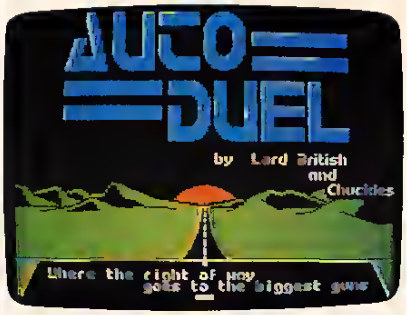
Autoduel

James V. Trunzo

Requirements: Apple II-series computer with at least 64K RAM and a joystick. Disk only. Versions for the Commodore 64 and Atari 400/800/XL/XE computers are scheduled for release late this summer. Versions for Macintosh, IBM, Amiga, and Atari ST are also planned.



Based on the popular board game *Car Wars* by Steve Jackson, *Autoduel* is essentially a futuristic role-playing game that takes the player out of a dungeon and places him on the outlaw-infested highways of the twenty-first century, "...where the right of way goes to the biggest gun." However, *Autoduel* also requires a mastery of the arcade-style game skills called upon in the popular *Spy Hunter* computer game (which it closely resembles in many ways). Finally, *Autoduel* demands strategy, logic, and planning. It's really a game within a game within a game.

In *Autoduel* your chief characteristics are not strength, dexterity, and wisdom; instead you split beginning ability points among driving skill, marksmanship, and mechanical skills. With those attributes and $2,000, you find yourself in Albany, New York (one of 16 cities that make up the Northeast Sector as determined by the AAA—the American Autoduel Association), looking for courier jobs as a way to earn fame and fortune. Because of the deadly bandits and underworld gangs who patrol the highways, drivers with guts and guns are needed to transport anything from valuable stamps to computer chips from one city to another.

Custom Cars

Computer role players will find that *Autoduel* offers a refreshing change of pace after one too many tours of various dungeons and demon-infested lands. Unique in many ways, *Autoduel* provides many of the same satisfactions as role-playing games, but it also offers an exciting new scenario with new challenges and unexpected situations.

The Driver is required to build his own car, designing it as he sees fit and as resources allow. This aspect of the game is almost as much fun as the actual highway shootouts. You must determine each characteristic of your car: how much armor it needs and where to put it, what weapons it will use, what kind of suspension best suits it, how much carrying capacity is required, etc. Certain types of designs will naturally be better for different types of jobs, and as you become more successful and more wealthy, you will end up with a stable of machines from which to choose. You'll be able to suit the car to the job.

The possible variations in car designs are endless, and each design opens up an entirely new spectrum of strategies and job possibilities. Obviously, a car designed like a war-wagon, containing every possible armament, would be deadly but slow-moving due to its weight; on the other hand, a car given maximum engine power, but lightly armed, would be a highly mobile, easily maneuvered machine. The various cars would require various strategies and tactics to derive the maximum benefit.

Clones, Vigilantes, Outlaws

The world of *Autoduel* includes many challenges and adventures. Most cities have arenas where deadly races are held nightly. A driver can earn money and prestige in the arena...or death. In Atlantic City, stop at a casino and gamble away the money you've just been paid for delivering a rare pet to a zoo. In Philadelphia, visit a Gold Cross building and have a clone created: If you die, he—or rather, it—will take your place.

Of course, you don't have to be a courier; you could be a vigilante, gunning for outlaws; or maybe, just maybe, you might prefer to be an outlaw yourself.

Autoduel is more than a game—it's a complete system of play. There is a wealth of additional features we don't have room to cover, and the overall game play is excellent.

Now you too can be a Road Warrior, ridding the highways of those who would control them for the wrong purposes. And remember the AAA's motto: "Drive offensively! The life you save may be your own." This exciting program is highly recommended.

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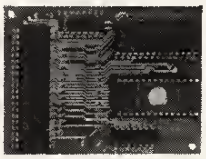

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ArcticFox For Amiga

Robert J. Stumpf

A bolt of lightning shatters the darkness, momentarily joining earth and sky on the distant horizon. The tops of nearby ridges are burned into your vision, lingering briefly, to be replaced by the uncertain sense of barely perceived shapes all around. Inside, the dimly lit control panel and the flashing static on the useless radar display combine with the ever-present clanking and grinding of your tracks to echo nature's efforts outside. It's small comfort to know that the storm will also hamper the aliens in their efforts to locate and destroy your battle tank, the ArcticFox. As you grind on through the dark, you peer through the viewport at the world outside and try to find order in your occasional glances at the erratic radar screen. the ArcticFox moves slowly inward, from the entry point through the perimeter force field toward what you hope is the alien command center, which is even now directing all of the forces gathered against you.

Slowly, the storm outside begins to subside, and you head toward dimly seen mountains on the horizon. As the

radar begins to function effectively once more, you pick up two alien units on the scope, bearing down from the north at a speed which could only be that of aircraft.

Quickly, you reverse to the left to help the gun move as rapidly as possible. This time, you make it with seconds to spare and spot the pair of aircraft just as your warning system indicates that your presence has been reported to the alien's command center. The aircraft are still out of your gun's range, but there is no time to wait—your primary mission is to destroy the command center, not to play tag with alien birds. You check your missile stores, then execute a quick launch. The radar display is replaced by a view from the camera in the nose of the missile. Except for changing direction, the ArcticFox's controls and your fate are now locked into the missile's flight guidance system.

As you guide the missile in toward the target, the aircraft roll sideways and begin to separate. A quick flip to the right, and you see your target looming large on the missile's screen. With a flash and a sound like thunder, one of them is gone. Now it's up to the gun, as the survivor swoops down on you. A little quick maneuvering with ArcticFox's restored controls, and you tense as the shells come toward you. A near miss, thanks to your maneuvers, and now your gun swivels to track your attacker. You press the fire button, and the voice of ArcticFox speaks with a loud roar. A direct hit, and now there are none. But much remains to be completed.

The foregoing action is an excerpt from *ArcticFox*, a strategy/action game for the Amiga from Electronic Arts. With 3-D full-color graphics and incredibly realistic sound (even to the track noises changing when you drive up a hill or over a destroyed enemy vehicle), *ArticFox* provides a very sophisticated Arctic environment of snowfields, glaciers, hills, ridges, mountains, and impassable crevices in the icy terrain. Over these barriers you must drive your ArcticFox supertank to fight against a legion of alien tanks, aircraft, rocket

HOTWARE: Software Best Sellers

This Month	Last Month	Title	Publisher	Remarks	Systems: Apple	Atari	Commodore	IBM	Macintosh
Entertainment									
1.	1.	*Elite*	Firebird Licensees, Inc.	Action/adventure	•		•		
2.	3.	*Ultima IV*	Origin Systems, Inc	Fantasy game	•	•	•		
3.	2.	*The Bard's Tale*	Electronic Arts	Adventure/role-playing game	•		•		
4.		*Phantasie II*	Strategic Simulations, Inc	Fantasy/role-playing game	•		•		
5.		*Silent Service*	MicroProse	Submarine simulation	•	•	•	•	
Education									
1.	2	*Math Blaster!*	Davidson	Introductory math program, ages 6-12	•	•	•	•	
2.		*Typing Tutor III*	Simon & Schuster	Typing instruction program	•		•	•	•
3.		*Reader Rabbit And The Fabulous Word Factory*	The Learning Company	Reading readiness program, grades K-2	•	•	•	•	
4		*New Improved MasterType*	Scarborough	Typing instruction program	•	•	•	•	•
5.		*Rocky's Boots*	The Learning Company	Science and logic program, ages 10 and up	•		•	•	
Home Management									
1.	3.	*Print Shop*	Broderbund	Do-it-yourself print shop	•	•	•		
2.	5	*Print Shop Companion*	Broderbund		•	•	•		
3	2	*The Newsroom*	Springboard	Do-it-yourself newspaper	•		•	•	•
4.	1.	*Better Working Spreadsheet*	Spinnaker	Spreadsheet	•		•		
5		*Word Perfect*	WordPerfect	Word processor	•			•	

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launchers, and reconnaissance sleds. Each threatens your mission, which is to destroy the enemy's command center. Time is crucial, since inside the alien's force field, oxygen converters are busily replacing the earth's air with an alien atmosphere. Your overall strategy for penetrating the alien defenses, and your tactical skill in maneuvering and fighting with the ArcticFox, will make all the difference.

ArcticFox contains a preliminary training scenario in addition to both Beginner and Tournament levels of play. You'll appreciate this. Practice is necessary, as both levels of play offer a challenge to your ability to outmaneuver the computer-directed alien forces and outfight them, if you must. This game combines lengthy periods of strategic maneuvers with fast and furious tactical action, and should appeal not only to those with lightning-quick reflexes and uncanny eyesight, but also to those with a taste for both strategy and action.

ArcticFox
Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404
$39.95

Paul Whitehead Teaches Chess

Larry Krengel

Requirements: Apple II-series computer with 64K minimum; Commodore 64; IBM PC/PCjr and compatibles. A disk drive is also required.

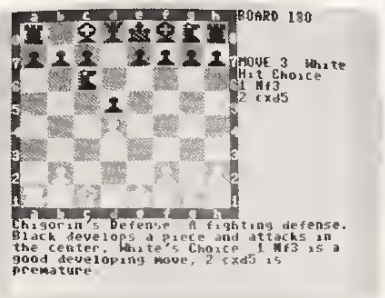
Paul Whitehead was a better chess player than the average high school student. So good, in fact, that before he completed his teenage years he had won a number of chess titles, including the Masters Division of the American Chess Championship. Now, the young chess master has concocted a computer chess tutorial which includes a program that teaches the fine points of the age-old game of chess, as well as a chess program for you to play against.

Paul Whitehead Teaches Chess is two programs contained on several disks—for example, a four-disk set in the Apple version and a three-disk set for Commodore. The main instructional program provides tutoring for what Whitehead terms "absolute beginner to middle-level" players. (By the way, his middle level is well above my high level.) The second program, called *The Coffeehouse Chess Monster*, is a chess opponent program.

The tutorials are divided into 11 groups. A poster-size road map gives the user an overview. The tutorials covering the rules include topics such as *How the Pieces Move* and *How the Pieces Capture*, progressing to *Checkmate* and *Stalemate Is Better Than Losing*.

When you're ready to move on from the basics, other tutorials come under such headings as *Opening Principles, Tactics,* and *Strategy*. The last of these three—*Strategy*—includes 167 separate screens.

Despite the large size of the tutorial, you're never stuck within the program. I really appreciated the fact that I wasn't trapped in any long runs of sequenced screens. I could duck out any



time I wanted and move to any other screen I requested.

I've been playing chess for over 30 years, but I never heard of Grob's Attack or a Pirc Defense. Paul has, and he includes it in his instruction. Do you know what Giuoco Piano is, or how to handle a desperate knight? Whitehead will fill you in.

If you must sacrifice a piece, you'll find five good ways to do it. When you think you know your stuff, try one of the quizzes contained in the program.

At any time, with any board on the screen, you can invite the *Coffeehouse Chess Monster* to play out the board. You can choose which side you want to play. In fact, you can even ask the *Monster* to play both sides while you watch. The chess program has nine levels of play, and uses the standard algebraic notation system—as does the tutorial program.

Before I finish, I really must mention the documentation—all four pages of it. That's right—a total of four *small* pages of instructions. The program is just that simple to use.

If you want to sharpen your chess game, your money will be well invested in *Paul Whitehead Teaches Chess.*

Paul Whitehead Teaches Chess
Enlightenment
1240 Sanchez St.
San Francisco, CA 94114
$49.95

Brimstone

Neil Randall

Requirements: Apple II-series computer with 64K minimum; Commodore 64; Atari 400/800/XL/XE (64K minimum with two disk drives); Atari ST computer; IBM PC/PCjr and compatibles; Apple Macintosh.

Brimstone, the third release in Brøderbund/Synapse's Electronic Novels series, is perhaps the most literary of all text adventures to date. Literary, that is, in its constant attempt to place the player in a world that recalls other stories and other worlds seen before. With references throughout to Dante, William Blake, and the medieval romance *Sir Gawain and the Green Knight*, *Brimstone* occupies a special place in the history of the computer text adventure.

The Dream Vision

Not that it's the first adventure to refer to other books. Far from it. Windham Classics' *Treasure Island, Alice in Wonderland,* and *The Wizard of Oz* are based on existing books, as are Telarium's *Fahrenheit 451* and *Nine Princes in Amber*, Infocom's *The Hitchhiker's Guide to the Galaxy*, Bantam's *The Fourth Protocol*, and Addison-Wesley's *The Hobbit*. What separates *Brimstone* from these adventures is that *Brimstone* is not an *adaptation*. *Brimstone*'s adventure alludes to several literary works, and the allusions are enticing, but it is an entirely new story.

Brimstone traces the dream vision of Sir Gawain, an Arthurian knight. The player's commands move Gawain from place to place through the dream, and the knight—like all knights worth their salt—has a specific quest and a specific deadline by which to accomplish it. In this sense, the story is reminiscent of the period of medieval romance characterized by the poem *Sir Gawain and the Green Knight*. Knowing the poem doesn't help in general, but to end the quest (and this shouldn't give too much away), it won't hurt to have finished reading the poem.

The world of the dream vision is not Arthurian England. Most of the travels take the knight through a combination of Dante's hell (from the *Inferno*) and William Blake's special world. To give just a couple of examples of how *Brimstone* reflects its literary sources: the knight meets Blake himself (and other Blakean characters), and on his wall is a painting that shows the scenes from Blake's great poetic work, *Songs of Innocence*. And the Underworld sequence starts in the great ice

field of the *Inferno*, which science fiction fans might know from the Niven-Pournelle novel of the same name.

A Sense Of Being There

It plays well. Like the other two works in the Electronic Novels series, *Mindwheel* and *Essex, Brimstone* has a sophisticated parser and is a pleasure to read. It does take a long time to play if you have a Commodore 64, because it continually accesses the disk.

It is not extremely difficult; there is a way out of each trouble area, and there are no impossible puzzles (I say this even though I've hit what seems a dead end, for the time being anyway.) But the descriptions are useful and detailed, providing a real sense of being there, and the quest is both unique and interesting. I know that there are no adventures like it, and there may never be again. Its greatest appeal is to those who have read a fair bit, but it should appeal to all adventure gamers.

There is a sense that *Brimstone* is a book to read, not a game to play. I personally feel that we need more such products, but fans of *ZORK*-like puzzles may not agree. You are taken step by step through the story, and you get stuck only infrequently. Furthermore, the game's difficulty increases as you go through it; most of the head scratching comes toward the end. As literature, it's excellent—the story's end should be its climactic and most gripping part—but games often fail in this respect. Still, there is enough to *Brimstone* to keep you occupied for a long time, whether or not you are interested in the literature from which it is derived. All in all, this is the best so far in a very promising series.

Brimstone
Broderbund/Synapse
17 Paul Dr.
San Rafael, CA 94903-2101
$44.95 (Apple II series, Macintosh, IBM, and Atari ST)
$39.95 (Commodore 64 and Atari 400/800/XL/XE)

Fooblitzky

James V. Trunzo

Requirements: Apple II+, IIe, or IIc computer with a minimum of 128K; Atari XL or XE computer with a minimum of 48K and 810 or 1050 disk drive; or IBM PC/XT/AT computer and compatibles with 128K, graphics card, and preferably a composite monitor.

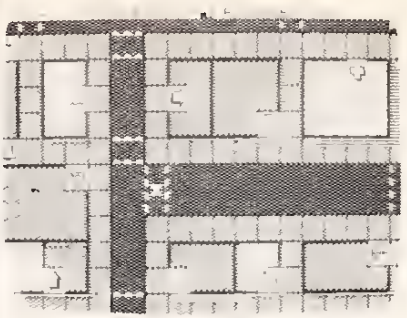
Fooblitzky is a city. The "coin of the realm" is the fooble. The inhabitants of Fooblitzky (meaning you and any other players) are dogs. Except for the Chanceman: He's the guy in the black cape who might give you foobles or a free turn—or drop a piano on your head, sending you to the hospital. Sound bizzare? It is. Sound like fun? You bet.

Fooblitzky is a new release from Infocom, and it's unlike anything previously offered by the company. Combining many elements found in popular board games, *Fooblitzky* is a computerized scavenger hunt, enhanced by animated graphics. Each player—personified by a dog—must acquire 4 correct items out of a possible 18 and return them to a checkpoint to be declared the winner. Certainly, it's not as easy as it sounds.

Standing between you and success are numerous obstacles,. not of the monster type, but more appropriately, of the nuisance type. The Chanceman, for instance, might appear on any turn and swipe one of your cherished objects; or another player may choose to bump you by landing on your space, knocking all the objects you are carrying to the ground, and then taking one of them. You could also get hit by a car while crossing a street and end up in the hospital. Or you simply might have the wrong objects.

If this sounds too juvenile, not to worry. The game's mechanics are amusing and simple, but the underlying principles around which the game is built are the same ones which make Monopoly a classic. The need for logic and strategy are essential and challenging. As a player, you must always observe, eliminate, and plan. You must constantly make decisions. How to move, where to move, how many foobles to spend, what objects to buy, to cross against traffic or to lose time waiting for a light to change are questions that must be resolved. Like a game of chess, it helps to think several turns ahead because you're racing against the other players, whose purpose is the same as yours.

Probably no game on the computer software market today gives one the



feel of playing a board game as much as does *Fooblitzky*. From the spinning roulette-type wheel (which dictates how many moves you have per turn) to the movement around the game board on the screen, *Fooblitzky* marries the bookkeeping skills of the computer to the tactile satisfaction of board gaming. Also adding to this board game quality are the package contents: four colorful wipe-off workboards, four matching markers, the Fooblitzky Official Ordinances, and, of course, the computer disk.

Fooblitzky is a tough game to review. It's so different from other computer games that it almost requires that one look at the entire package before buying it—because it probably isn't for everyone's tastes. However, if you're looking for a game which the entire family can play and enjoy, this 2–4 player game might be the ideal choice.

Fooblitzky
Infocom
125 CambridgePark Dr.
Cambridge, MA 02140
$39.95 (all versions)

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Gulf Strike

Michael B. Williams

Requirements: Atari home computer with 48K, joystick required; Apple II+, IIc, IIe with 48K, joystick optional; Commodore 64, joystick required; IBM PC/PCjr with 128K.

Gulf Strike is a demanding computer war-game simulation in which you compete for territory in and around the Persian Gulf and the country of Iran. One player is allied with the U.S.–Iranian forces, while the other commands the Soviet-Iraqi forces. You may play against another person or the computer.

The balance of victory in *Gulf Strike* depends on how many of the 21 victory point squares (actually key cities in the Middle East) are controlled by each player. At the onset of the war, the U.S.–Iranian forces control all 21 point squares. Within the game's 25 turns, the Soviet-Iraqi player must capture 9 of these victory point squares to be declared victorious; the U.S.–Iranian player must retain at least 13 victory point squares to win the game.

Once the winning side is determined, the game calculates the magnitude of victory. This value equals the number of enemy hit points eliminated plus bonus points (for the Soviet-Iraqi player, based on how fast he or she overtakes the 9 victory point squares, and for the U.S.–Iranian player, based on the number of victory point squares that the Soviet-Iraqi player failed to win).

Realistic Terrain

The playing area is represented as a map extending west to east from the Tigris and Euphrates Rivers to the eastern border of Iran and north to south from the Caspian Sea to the north coast of the Persian Gulf—an area covering 784 square kilometers. The onscreen map scrolls in eight directions and shows the location of all ground, air, and naval units. The map also shows the type of terrain in each square kilometer. True to the actual terrain, the map shows deserts, towns, swamps, rivers, and mountains.

Each turn represents two days of realtime and consists of three distinct phases: ground/naval movement, air movement and combat, and ground/naval combat. During the ground/naval movement phase, the players take turns changing and moving their ground and naval forces into strategic positions, taking into account the various types of terrain. During the air movement and combat phase, each player forms an air mission to strike at ground and naval units. The third phase is the resolution of ground combat by the computer.

Each type of unit has a separate type of display which describes its current status. For example, a ground status window indicates the unit's formation (one of 6 possibilities); the number of movement and hit points remaining for the unit; its nationality, size, and type (one of 13); and its combat values (how much damage it can inflict on the ground, in the air, or on or beneath the sea). The air and naval status windows are similar, but tailored for airplanes and ships.

Gulf Strike does not attempt to portray the details of combat on the screen. Instead, it relays information regarding the success and failure of combat through a status window at the bottom of the screen, and by simple sound effects. With the exception of the IBM version, there is no way to turn off the sound when you tire of it (of course, if you are using a Commodore 64, you can simply turn down the volume on your monitor).

Each phase in *Gulf Strike* moves slowly. Scrolling through the vast playing area is a slow process, so it takes considerable time to probe the abilities of your units. A full 25-turn game will certainly take hours to play. For this reason, Avalon Hill has included a save-game feature.

Formidable Documentation

As with most entertainment software, the temptation is to dive right into the program with only a glance at the manual. With *Gulf Strike*, this is impossible. The game requires a thorough knowledge of how to play before you begin. Since the game does not occur in real-time, however, you have plenty of time to read the manual between turns, as you play the game. Even if you choose to learn as you go, you will probably want to read the entire manual at some point, in order to understand fully what is going on.

The 43-page manual is necessarily complex and includes an index for quick reference. It states that the clarity of the rules has been verified by Software Testers of Universal Microcomputer Programmers (STUMP) and deemed complete by them in all facets of instruction. Nonetheless, the high level of difficulty of the rules is likely to deter some new war-gamers completely, and may even hamper some seasoned gamers. Be forewarned: *Gulf Strike* is neither a simple nor a simple-minded game. Playing well requires a thorough understanding of all the rules.

The IBM PC/PCjr version of *Gulf Strike* offers several advanced features

and is played entirely with keyboard commands. This version includes the additional commands Help, Identify, Go to a city, and Magnify map. All of the expansions and modifications for IBM are detailed in an addendum to the manual. The Commodore, Atari, and Apple II versions allow the entire game to be played by joystick.

Gulf Strike is not a game to be mastered easily and, for this reason, it is recommended only for experienced war-gamers. The game itself is devoid of polish or glitter, but offers a wide range of features. Dedicated players may appreciate the fact that very few events are determined automatically by the computer. If you're the type of strategist who enjoys taking complete control of the action, *Gulf Strike* is well worth your consideration.

Gulf Strike
The Avalon Hill Game Company
4517 Harford Road
Baltimore, Maryland 21214
All versions $30.00 ©

Design 64

Joseph Sexton

This full-featured artistic programming tool allows you to draw, paint, erase, and save your creations. Using the multicolor high-resolution screen as a canvas, you can easily design a colorful picture or background screen for use in BASIC programs or arcade-style games. "Design 64" is written entirely in machine language, but no machine language knowledge is required to use it. This article also includes a short BASIC program which loads and displays any hi-res picture. A joystick is optional.

The Commodore 64 can display complex, detailed high-resolution pictures, but creating such displays from BASIC can be a slow, complicated process. Like commercial drawing programs, "Design 64" lets you draw directly on the hi-res screen and create highly detailed, multicolor images, even if you're not a programmer. Once you've drawn a picture, you can save it to disk or tape and reload it for future viewing or further enhancements. Since Design 64 is written entirely in machine language, you must enter Program 1 with "MLX," the machine language entry program published elsewhere in this issue. Follow the MLX instructions carefully. When you run MLX, you'll be asked for a starting address and an ending address. Here are the addresses you need to enter Program 1 with MLX:

Starting Address: 4CB0
Ending Address: 5537

Load Design 64 with the command LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape. To activate the program, type SYS 19632 and press RETURN.

Hi-Res Drawing

When you activate Design 64, a yellow pen appears on a blank white screen. You can move the pen around the screen with keyboard controls or with a joystick in port 1. On the keyboard, the I, J, L, and comma keys move the pen up, left, right, and down, respectively. The U, O, M, and period keys move the pen diagonally to the upper left, upper right, lower left, and lower right, respectively. The pen has two speeds for drawing; press the f7 key to switch from one speed to the other. The slower speed is useful when you're doing fine-detail work or using the joystick, which moves the pen considerably faster than the keyboard controls.

The f1 key cycles through all of the 16 available drawing colors, in the order described in the 64 user's manual. The f3 key cycles the screen background color, and f5 cycles the screen border color.

Press the f2 key (SHIFT-f1) to save or load a picture file or exit the program. If you choose the SAVE or LOAD option, the program prompts you to enter the desired filename, then choose disk or tape. When it saves a picture, Design 64 automatically stores the picture's hi-res bit pattern, color memory, background color, and border color in a single file.

Press f8 (SHIFT-f7) to enter block-fill mode. In this mode, the pen fills an area below and to the right of its current position, using the current drawing color. Nonrectangular shapes may have to be colored in two or more operations. Note that you must select the higher drawing speed when using this option.

This hi-res picture was created with "Design 64," a powerful, convenient drawing program for the Commodore 64.

Four Drawing Pens

You may have noticed by now that the top of the drawing pen is initially labeled with the letter *C*. Design 64 actually offers four different drawing pens, labeled *C*, *Z*, *X*, and *V*. To switch from one pen to another, press the corresponding letter on the keyboard. The reason for using four pens is a bit complicated, but understanding it is essential to using the program successfully.

When you turn on the 64, it defaults to the standard character mode. In this mode the screen is divided into 40 columns and 25 rows of squares, for a total of 1000 squares. Each square can hold one character, and is assigned a single location in memory. Collectively, this group of squares is known as *screen memory*. For each square in screen memory, there exists a matching memory location which holds that square's color. This

group of 1000 locations is known as *color memory*. A character or color code occupies one byte of memory, so both screen memory and color memory require 1000 bytes of memory. Text mode permits only one color per square (in addition to the screen background color which shows through the gaps in the character).

In multicolor high-resolution mode, the screen is organized quite differently. Instead of 1000 character-sized squares, the screen is divided into 64,000 individual dots called pixels. Each pixel has a corresponding bit in memory. If the bit is set to 1, then the corresponding pixel is lit up. If the bit contains 0, the pixel is off (dark). Since there are eight bits per byte, the high-resolution screen requires 8000 bytes of memory to store picture data.

There is not an individual color memory location in multicolor hi-res mode for each pixel. Instead, color memory is divided into 1000 squares, each square containing 64 pixels. You may have as many as three different colors in each square, plus the background color. This is the reason for using four pens. Drawing lines of three different colors within a given color square requires that you use three different pens. To see what a square looks like, draw a medium-sized box on the screen and color it in. Then move the pen to the center of the box and press f1. Instantly, one square will change to the new color. Fortunately these squares are rather small; you can achieve good color density by identifying which pixels share color squares and taking this into account when designing your picture.

The Z pen has two functions: moving the pen without drawing, and erasing. To move the pen without disturbing anything, press Z. If you press the A key, the Z label appears and the Z pen erases whatever it travels over. Press A a second time to exit erase mode. To erase the entire screen, press SHIFT–CLR/HOME (be careful not to erase a picture by accident—there's no way to undo the operation).

Each of the pens except the Z pen (which doesn't draw) can have any of the 16 available colors. To change the color of a pen, select the pen and press f1 until the desired color appears. The X pen is the only one that always draws its color over other colors. The C and V pens have no special features. When your picture is complete, move the pen off the right edge of the screen for an unobstructed view. It is not necessary to do this when saving a screen, since the pen is not saved with the picture.

Hi-Res Screens From BASIC

Program 2 allows you to load and display a previously designed hi-res picture without having to run Design 64. Replace NAME in line 10 with the name of the picture file you wish to load. If you're using tape instead of disk, change the 8 to 1 in line 10. The hi-res graphics data load into memory locations 24568–32567, well out of the way of most BASIC programs. The video matrix which normally appears in locations 1024–2023 is moved to locations 23552–24551. This area stores color information—specifically, color codes produced by the C and V pens—in multicolor hi-res mode. Color codes for the X pen are stored in the regular color memory area from 55296–56295.

When Design 64 saves a picture, it moves color memory to the zone just above screen memory, then saves the entire area from 23552–33578 as a program (PRG format) file. Line 30 of Program 2 transfers this data back to the original location. Sprite pointers, which are normally located just above screen memory, are also moved to locations 24568–24575. Note that these pointers can only point to memory locations in video bank 1, which begins at 16384. Sprite shape data may be located anywhere in the area from 16384–23551, a 7168-byte zone big enough to hold 112 sprite shapes. Don't attempt to store sprite data above this area: The remainder of bank 1 contains the hi-res bitmap and color memory.

When you select a drawing pen (X, C, or V), it immediately places a dot of color on the screen. To avoid needless erasing, position the pen in the desired spot with Z before you switch to a drawing pen. When you wish to fill an irregular figure, it often saves time to draw a box inside your figure and fill that block first. Then you can finish the missing areas by hand. Note that the block-fill routine will only color over a blank screen; when the pen hits a nonzero location on a downward move it ends the routine.

Due to the 64's internal wiring, four of the keys mimic the effect of moving a joystick in port 1. The 1, left-arrow, CTRL, and 2 keys correspond to up, down, left, and right, respectively. If you're using keyboard controls, you can use this feature to your advantage to move the pen faster than usual.

Program 1: Design 64

Please refer to the "MLX" article in this issue before entering the following listing.

```
4CBØ:A9 77 8D CB 5D A9 3E 85 FD
4CB8:8B A9 4E 85 8C 4C ØØ 4E 87
4CCØ:ØØ Ø3 FE ØØ Ø4 Ø1 ØØ Ø4 22
4CC8:79 ØØ Ø4 11 ØØ Ø4 21 ØØ Ø2
4CDØ:Ø4 79 ØØ Ø8 Ø1 ØØ 11 FE 73
4CD8:ØØ 22 ØØ ØØ 44 ØØ ØØ 88 A4
4CEØ:ØØ Ø1 1Ø ØØ Ø2 2Ø ØØ Ø4 5Ø
4CE8:4Ø ØØ Ø8 8Ø ØØ 11 ØØ ØØ EE
4CFØ:22 ØØ ØØ 24 ØØ ØØ 78 ØØ CD
4CF8:ØØ 6Ø ØØ ØØ 8Ø ØØ ØØ ØØ AD
4DØØ:ØØ Ø3 FE ØØ Ø4 Ø1 ØØ Ø4 63
4DØ8:39 ØØ Ø4 41 ØØ Ø4 41 ØØ 66
4D1Ø:Ø4 39 ØØ Ø8 Ø1 ØØ 11 FE A4
4D18:ØØ 22 ØØ ØØ 44 ØØ ØØ 88 E5
4D2Ø:ØØ Ø1 1Ø ØØ Ø2 2Ø ØØ Ø4 91
4D28:4Ø ØØ Ø8 8Ø ØØ 11 ØØ ØØ 3Ø
4D3Ø:22 ØØ ØØ 24 ØØ ØØ 78 ØØ ØF
4D38:ØØ 6Ø ØØ ØØ 8Ø ØØ ØØ ØØ EE
4D4Ø:ØØ Ø3 FE ØØ Ø4 Ø1 ØØ Ø4 A3
4D48:85 ØØ Ø4 49 ØØ Ø4 31 ØØ 2D
4D5Ø:Ø4 49 ØØ Ø8 85 ØØ 11 FE ØD
4D58:ØØ 22 ØØ ØØ 44 ØØ ØØ 88 26
4D6Ø:ØØ Ø1 1Ø ØØ Ø2 2Ø ØØ Ø4 D1
4D68:4Ø ØØ ØB 8Ø ØØ 11 ØØ ØØ 7Ø
4D7Ø:22 ØØ ØØ 24 ØØ ØØ 78 ØØ 4F
4D78:ØØ 6Ø ØØ ØØ 8Ø ØØ ØØ ØØ 2F
4D8Ø:ØØ Ø3 FE ØØ Ø4 Ø1 ØØ Ø4 E3
4D88:89 ØØ Ø4 89 ØØ Ø4 51 ØØ B3
4D9Ø:Ø4 21 ØØ Ø8 Ø1 ØØ 11 FE 1F
4D98:ØØ 22 ØØ ØØ 44 ØØ ØØ 88 66
4DAØ:ØØ Ø1 1Ø ØØ Ø2 2Ø ØØ Ø4 12
4DA8:4Ø ØØ Ø8 8Ø ØØ 11 ØØ ØØ BØ
4DBØ:22 ØØ ØØ 24 ØØ ØØ 78 ØØ 8F
4DB8:ØØ 6Ø ØØ ØØ 8Ø ØØ ØØ ØØ 6F
4DCØ:ØØ Ø3 FE ØØ Ø7 FF ØØ Ø7 3B
4DC8:FF ØØ Ø7 FF ØØ Ø7 FF ØØ 6Ø
4DDØ:Ø7 FF ØØ ØF FF ØØ 1F FE 1D
4DD8:ØØ 3E ØØ ØØ 7C ØØ ØØ F8 DF
4DEØ:ØØ Ø1 FØ ØØ Ø3 EØ ØØ Ø7 7C
4DE8:CØ ØØ ØF 8Ø ØØ 1F ØØ ØØ 4A
4DFØ:3E ØØ ØØ 3C ØØ ØØ 78 ØØ 5F
4DF8:ØØ 6Ø ØØ ØØ 8Ø ØØ ØØ ØØ AF
4EØØ:A2 34 8E F8 5F A2 37 BE DE
4EØ8:F9 5F A2 ØØ 8E 27 DØ A2 23
4E1Ø:Ø7 8E 28 DØ A2 Ø3 8E 15 39
4E18:DØ A2 B7 4C 3Ø 4E D8 D4 C2
4E2Ø:ØØ ØØ ØØ ØØ Ø1 Ø4 1Ø 4Ø 35
4E28:Ø2 Ø8 2Ø 8Ø Ø3 ØC 3Ø CØ 3D
4E3Ø:BE ØØ DØ 8E Ø2 DØ AØ 7D 29
4E38:8C Ø1 DØ 8C Ø3 DØ FC F3 87
4E4Ø:CF 3F EA EA EA EA A9 Ø2 F8
4E48:8D 56 Ø3 A9 Ø5 8D 57 Ø3 4C
4E5Ø:A9 Ø7 8D 58 Ø3 A9 FF BD Ø7
4E58:8A Ø2 A9 ØØ 8D 52 Ø3 A9 55
4E6Ø:CB 85 4B 85 4D A9 D9 85 5Ø
```

```
4E68:4C A9 5D 85 4E A9 5F 85 F6
4E70:FB A9 6E 85 FC A9 07 8D C5
4E78:53 03 A9 24 85 FD A9 4E BC
4E80:85 FE A9 3F 8D 02 DD A9 A2
4E88:96 8D 00 DD A9 D8 8D 16 93
4E90:D0 A9 3B 8D 11 D0 A9 78 D7
4E98:8D 18 D0 A9 01 8D 20 D0 06
4EA0:8D 21 D0 A9 00 85 22 A9 05
4EA8:60 85 23 A9 40 85 24 A0 D6
4EB0:00 A9 00 A2 7F 91 22 E6 4F
4EB8:22 D0 FA E6 23 E4 23 D0 2C
4EC0:F4 A6 24 E8 91 22 E6 22 99
4EC8:E4 22 D0 F8 EA A9 60 8D 56
4ED0:CC 4E 4C 76 50 A9 00 8D 0F
4ED8:54 03 AD 10 D0 D0 16 EE FB
4EE0:00 D0 EE 02 D0 D0 05 A9 2D
4EE8:FF 8D 10 D0 EE 00 D0 EE FF
4EF0:02 D0 4C 0B 4F AD 00 D0 FE
4EF8:C9 57 D0 03 4C 76 50 EE 66
4F00:00 D0 EE 00 D0 EE 02 D0 C7
4F08:EE 02 D0 CE 52 03 30 03 A7
4F10:4C 28 50 A9 03 8D 52 03 79
4F18:D8 18 A5 FB 69 08 85 FB 10
4F20:90 02 E6 FC E6 4B E6 4D B3
4F28:D0 04 E6 4C E6 4E 4C 3E 19
4F30:50 A9 00 8D 54 03 AD 10 54
4F38:D0 D0 19 AD 00 D0 C9 19 61
4F40:D0 03 4C 76 50 CE 00 D0 87
4F48:CE 02 D0 CE 00 D0 CE 02 B8
4F50:D0 4C 67 4F CE 00 D0 CE 33
4F58:02 D0 D0 05 A9 00 8D 10 0F
4F60:D0 CE 00 D0 CE 02 D0 EE 37
4F68:52 03 A9 04 CD 52 03 F0 15
4F70:03 4C 28 50 A9 00 8D 52 68
4F78:03 A5 FB E9 08 85 FB B0 1F
4F80:02 C6 FC C6 4B C6 4D A9 97
4F88:FF C5 4D D0 04 C6 4C C6 E9
4F90:4E 4C 3E 50 A9 01 8D 54 F6
4F98:03 AD 01 D0 C9 E5 D0 03 DB
4FA0:4C 76 50 EE 01 D0 EE 03 28
4FA8:D0 18 E6 FB D0 02 E6 FC AB
4F80:EE 53 03 AD 53 03 C9 08 19
4FB8:F0 03 4C 28 50 A9 00 8D 53
4FC0:53 03 18 E6 FC A5 FB 69 1B
4FC8:38 85 F8 90 02 E6 FC 18 2B
4FD0:A5 4B 69 28 85 48 85 4D 76
4FD8:90 04 E6 4C E6 4E 4C 3E A9
4FE0:50 A9 01 8D 54 03 AD 01 16
4FE8:D0 C9 1E D0 03 4C 76 50 89
4FF0:CE 01 D0 CE 03 D0 C6 FB 23
4FF8:A9 FF C5 FB D0 02 C6 FC FD
5000:CE 53 03 10 23 A9 07 8D 99
5008:53 03 C6 FC A5 FB E9 38 E4
5010:85 FB B0 02 C6 FC 18 A5 A8
5018:4B E9 27 85 4B 85 4D 80 D1
5020:04 C6 4C C6 4E 4C 3E 50 DA
5028:A2 00 A1 FB AC 52 03 11 D3
5030:FD 81 FB A9 FF 85 A2 A5 4B
5038:A2 30 FC 4C 76 50 A5 FD D8
5040:A2 00 C9 2C D0 05 AD 56 7A
5048:03 81 4B C9 28 D0 0A A1 0B
5050:4D 29 F0 18 6D 57 03 B1 D1
5058:4D C9 24 D0 16 A1 4D 29 9E
5060:0F 8D 7A 03 AD 58 03 A0 E0
5068:04 0A 88 D0 FC 18 6D 7A 49
5070:03 81 4D 4C 2B 50 A9 00 37
5078:20 E4 FF AE 01 DC E0 FB 86
5080:F0 04 C9 4A D0 03 4C 31 D4
5088:4F E0 F7 F0 04 C9 4C D0 C7
5090:03 4C D5 4E E0 FE F0 04 4E
5098:C9 49 D0 03 4C E1 4F E0 24
50A0:FD F0 04 C9 2C D0 03 4C 90
50A8:94 4F E0 F6 F0 04 C9 4F 6D
50B0:D0 0B AC 54 03 D0 03 4C 05
50B8:E1 4F 4C D5 4E E0 FA F0 E1
50C0:04 C9 55 D0 0B AC 54 03 44
50C8:D0 03 4C E1 4F 4C 31 4F 97
50D0:E0 F9 F0 04 C9 4D D0 0B EE
50D8:AC 54 03 D0 03 4C 94 4F 14
50E0:4C 31 4F E0 F5 F0 04 C9 31
50E8:2E D0 0B AC 54 03 D0 03 54
50F0:4C 94 4F 4C D5 4E C9 85 8C
50F8:D0 03 4C C4 51 C9 93 D0 42
5100:06 20 A3 4E 4C 76 50 C9 AD
5108:86 D0 10 AE 21 D0 E8 E0 0E
5110:10 D0 02 A2 00 8E 21 D0 A6
5118:4C FB 54 C9 89 D0 03 4C E8
5120:5D 53 C9 87 D0 10 AE 20 3C
5128:D0 E8 E0 10 D0 02 A2 00 5E
5130:8E 20 D0 4C 76 50 C9 8B 15
5138:D0 03 4C 76 50 C9 88 D0 80
5140:17 AE 34 50 E0 FF F0 08 96
5148:A2 FF 8E 34 50 4C 76 50 42
5150:A2 F6 8E 34 50 4C 76 50 08
5158:C9 8C D0 03 4C 3D 52 C9 13
5160:5A D0 12 A0 20 84 FD A0 60
5168:33 8C F8 5F AC 21 D0 8C F4
5170:28 D0 4C 3E 50 C9 58 D0 F3
5178:12 A0 2C 84 FD A0 35 8C 83
5180:F8 5F AC 56 03 8C 28 D0 DD
5188:4C 3E 50 C9 43 D0 12 A0 A9
5190:24 84 FD A0 34 8C F8 5F 55
5198:AC 58 03 8C 28 D0 4C 3E 2C
51A0:50 C9 56 D0 12 A0 28 84 9D
51A8:FD A0 36 8C F8 5F AC 57 F7
51B0:03 8C 28 D0 4C 3E 50 C9 CF
51B8:41 D0 03 4C 14 52 4C 76 4E
51C0:50 EA EA EA A5 FD C9 2C 37
51C8:F0 35 C9 28 F0 1C C9 24 9C
51D0:F0 03 4C 76 50 EE 58 03 8F
51D8:AD 58 03 C9 10 D0 05 A9 DC
51E0:00 8D 58 03 8D 28 D0 4C 1D
51E8:3E 50 EE 57 03 AD 57 03 92
51F0:C9 10 D0 05 A9 00 8D 57 A6
51F8:03 8D 28 D0 4C 3E 50 EE 7D
5200:56 03 AD 56 03 C9 10 D0 DB
5208:05 A9 00 8D 56 03 8D 28 74
5210:D0 4C 3E 50 AD 70 03 D0 03
5218:12 A9 31 8D 2F 50 A9 88 C8
5220:8D 30 50 A9 01 8D 70 03 5E
5228:4C 63 51 A9 00 8D 70 03 AA
5230:A9 11 8D 2F 50 A9 FD 8D 45
5238:30 50 4C 76 50 20 49 53 E2
5240:EA A9 4E 85 8E A9 60 8D 50
5248:38 50 AD 52 03 8D 5C 03 83
5250:AD 53 03 8D 5D 03 A5 FB 18
5258:85 35 A5 FC 85 36 A9 00 E9
5260:8D 5F 03 20 CB 52 A2 00 F2
5268:A1 35 AC 5C 03 31 8D F0 6F
5270:03 4C 14 53 AD 5E 03 D0 1F
5278:09 20 31 4F 20 A8 52 4C 59
5280:66 52 C9 01 D0 09 20 D5 F6
5288:4E 20 C8 52 4C 66 52 20 B8
5290:94 4F A9 00 8D 5F 03 AD 26
5298:60 03 D0 06 20 CB 52 4C C9
52A0:66 52 20 A8 52 4C 66 52 7E
52A8:A9 00 8D 5E 03 EE 5F 03 4F
52B0:EE 5C 03 A9 04 CD 5C 03 F1
52B8:F0 01 60 A9 00 8D 5C 03 AE
52C0:A5 35 E9 08 85 35 B0 02 A7
52C8:C6 36 60 A9 01 8D 5E 03 03
52D0:EE 5F 03 CE 5C 03 30 01 62
52D8:60 A9 03 8D 5C 03 18 A5 16
52E0:35 69 08 85 35 90 02 E6 AA
52E8:36 60 A9 02 8D 5E 03 18 1A
52F0:E6 35 D0 02 E6 36 EE 5D D8
52F8:03 AD 5D 03 C9 08 F0 01 B7
5300:60 A9 00 8D 5D 03 18 E6 28
5308:36 A5 35 69 38 85 35 90 43
5310:02 E6 36 60 AD 5E 03 8D B8
5318:60 03 D0 09 20 CB 52 20 4F
5320:EA 52 4C 66 52 C9 01 D0 4D
5328:09 20 A8 52 20 EA 52 4C 33
5330:66 52 A9 4C 8D 3B 50 A9 3C
5338:A9 8D 76 50 A9 00 8D 77 CA
5340:50 A9 20 8D 78 50 4C 76 6A
5348:50 A9 2C 85 8D A9 4C 8D 98
5350:76 50 A9 32 8D 77 50 A9 33
5358:53 8D 78 50 60 A9 4C 8D EF
5360:9B 4E A9 76 8D 9C 4E A9 2A
5368:50 8D 9D 4E A0 04 AD 00 A3
5370:D8 8D 41 7F EE 72 53 D0 BF
5378:03 EE 73 53 EE 6F 53 D0 AC
5380:06 EE 70 53 88 F0 03 4C 83
5388:6E 53 AD 21 D0 8D 29 83 95
5390:AD 20 D0 8D 2A 83 20 81 2A
5398:FF A9 FE 8D FE 5B 85 4F 22
53A0:A9 5B 8D FF 5B 85 50 A9 DF
53A8:97 8D 00 DD A9 3F 8D 02 C3
53B0:DD A9 01 8D 20 D0 8D 21 2A
53B8:D0 A9 00 8D 86 02 A2 14 A0
53C0:BD A0 54 20 D2 FF CA D0 F7
53C8:F7 20 E4 FF F0 FB 8D 84 27
53D0:03 C9 45 D0 03 4C 74 54 A7
53D8:C9 4C F0 07 C9 53 F0 03 86
53E0:4C BE 53 20 DB 54 A2 1A 59
53E8:BD B4 54 20 D2 FF CA D0 25
53F0:F7 A0 00 8C 7C 03 20 CF 84
53F8:FF 99 00 08 C8 EE 7C 03 84
5400:C9 0D D0 F2 CE 7C 03 EA 73
5408:EA EA EA EA EA EA EA B0
5410:EA EA EA EA 20 D2 FF A2 E3
5418:0C BD CE 54 20 D2 FF CA 6C
5420:D0 F7 20 E4 FF F0 FB C9 07
5428:54 D0 0B A0 01 8C 7D 03 D2
5430:20 E4 FF 4C 48 54 C9 44 52
5438:D0 0B A0 08 8C 7D 03 20 21
5440:E4 FF 4C 48 54 4C 17 54 BF
5448:AD 7C 03 A2 00 A0 08 20 24
5450:BD FF A9 02 AE 7D 03 A0 3F
5458:01 20 BA FF AD 84 03 C9 30
5460:4C F0 0C A9 4F A2 2C A0 85
5468:83 20 D8 FF 4C 74 54 A9 7C
5470:00 20 D5 FF A0 04 AD 41 8D
5478:7F 8D 00 D8 EE 77 54 D0 A0
5480:03 EE 78 54 EE 7A 54 D0 95
5488:06 EE 7B 54 88 F0 03 4C FE
5490:76 54 AD 29 83 8D 21 D0 37
5498:AD 2A 83 8D 20 D0 4C 0F D7
54A0:55 0D 0D 0D 54 49 58 45 67
54A8:20 52 4F 20 45 56 41 53 3B
54B0:2C 44 41 4F 4C 0D 0D 4E 9C
54B8:52 55 54 45 52 20 53 53 CB
54C0:45 52 50 20 2C 45 4D 41 FE
54C8:4E 20 52 45 54 4E 45 4B F0
54D0:53 49 44 20 52 4F 20 45 55
54D8:50 41 54 A2 02 C9 4C D0 4F
54E0:0D 8E 00 D8 8E 01 D8 8E F9
54E8:02 D8 8E 03 D8 60 8E 05 35
54F0:D8 8E 06 D8 8E 07 D8 8E C8
54F8:08 D8 60 E0 00 D0 08 A9 F2
5500:01 8D 27 D0 4C 76 50 A9 07
5508:00 8D 27 D0 4C 76 50 A9 8E
5510:00 8D 6F 53 8D 7A 54 A9 E9
5518:D8 8D 70 53 8D 78 54 A9 82
5520:41 8D 72 53 8D 77 54 A9 EE
5528:7F 8D 73 53 8D 78 54 4C DC
5530:B5 4C 00 00 00 00 00 00 C8
```

Program 2: Hi-Res Picture Loader

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing in Programs" in this issue of COMPUTE!

```
XQ 5 PRINT"{CLR}{10 DOWN}
     {11 RIGHT}JUST A MOMENT..
     ."
8E 10 IFA=0THENA=1:LOAD"DEMO",
     8,1
AR 20 PRINT"{CLR}{10 DOWN}
     {11 RIGHT}JUST A MOMENT.
     .":8=55296:C=33577
KH 30 FOR T=32577TO33576:POKE
     {SPACE}8,PEEK(T):8=8+1:N
     EXT
KS 40 POKE53281,PEEK(C):POKE53
     280,PEEK(C+1)
MP 50 POKE56578,63:POKE56576,1
     50:POKE53270,216:POKE532
     65,59:POKE53272,120
GH 60 REM SPRITE POINTERS NOW
     {SPACE}LOCATED AT 24568
     {SPACE}TO 24575
GA 70 REM STORE SPRITE DATA IN
      8ANK 1 8ETWEEN 16384 AN
     D 23552
GH 80 GOTO 80
```

Amiga Math Graphics

Warren Block

Is math boring? Before you answer, take a look at this Amiga BASIC program. It creates graceful, multicolored graphic designs based on a variety of interesting mathematical functions.

As one of my first Amiga programming projects, I decided to convert several Apple II+ hi-res graphics routines to run on my new machine. Originally, all these routines were written as one-liners: That is, the entire program would fit (just barely, sometimes) on one BASIC line. "Amiga Math Graphics" combines all of them into a single program. At the very least, these routines demonstrate the speed and power of the Amiga, while creating a pleasing visual display. At their best, perhaps they will convince you to explore the field of microcomputer graphics—a field which many people avoid because it seems difficult. Pictures are a fundamental part of communication, and being able to use graphics on the computer will improve your ability to communicate through that medium.

Type in the program and save a copy before you run it. The small ← character indicates where each program line ends. Don't try to type this character—we deliberately chose one that's not on the Amiga keyboard. The ← character merely shows where you should press RETURN to end one program line and start another.

Labeled Subroutines

Although the routines in this program were originally one-liners, it seemed a shame to keep them that way when AmigaBASIC makes it so easy to write neat, readable code. Each routine is marked with a descriptive label. Let's look at each of them in turn.

RightOvals. The basic formula used in this routine forms the basis for several different plotting routines. They all involve drawing a line from the perimeter of one oval to the perimeter of another. In this case, the line is drawn from a point on the first oval to a point halfway along the other.

SideOvals. Only minor changes were made to RightOvals to produce this interesting display. The second oval was tilted with respect to the first, and the line is plotted with an offset added to the x coordinate of the second oval.

Scaling Graphic Shapes

When the trigonometric functions sine and cosine are used for graphics, a problem arises because both of these functions return only values between 0 and 1. Without scaling (adjusting) the figures to fit the computer's display, you would see only three or four pixels in the middle of the screen. Scaling the display involves multiplying a set of coordinates by a constant amount. However, if you multiply both the x (horizontal) and y (vertical) coordinates by the same amount, the graph appears to be squashed horizontally on the screen. This occurs because the Amiga's aspect ratio (the ratio of horizontal to vertical pixels) is greater than 1. In plain English, there are more pixels across the screen than there are from top to bottom. To adjust for the aspect ratio, you must make the horizontal scaling factor larger than the vertical factor.

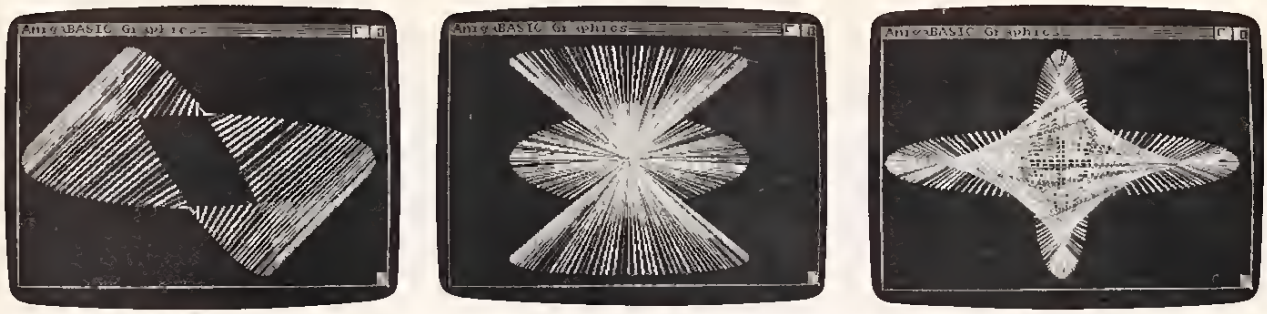
Other factors influence aspect ratio, including the type of monitor you have and the physical shape and relative locations of the pixels it displays. Some experimentation is required to find the best scaling values for any given display. In this program, the R variables (R1, R2, and so on) set the scaling factors for various routines. By changing these values, you can squash the shapes vertically or horizontally.

TwistedBand. Using a minor variation on the double-oval effect, this routine creates a display that looks remarkably like a twisted loop of paper. The only real difference from SideOvals is that an offset is added to the y coordinate of the second oval, not to its x coordinate.

Multilobe. This routine employs a common polar function which involves multiplying an angle theta by a fixed constant, then using this new value to compute the R value (theta and R are discussed at the end of this article). The effect is that of several squashed, distorted lobes instead of a plain circle. By setting the variable Lobes to 4, eight lobes are drawn. Try changing Lobes to different values (including nonintegers) for some interesting variations.

Show Your Colors

Before you bought an Amiga, you may have heard that it can display 4096 different colors. The low-resolution graphics screen lets you display as many as 32 different colors at once. If you're familiar with earlier computers, the Amiga's color system may seem confusing at first. On a Commodore 64, for example, color 2 is always red, and so on. But the Amiga, like the PC/PCjr, allows you to assign any color to color 2. The PALETTE statement allows you to define color 2 as black, magenta, or whatever you like. The color number simply provides a means for referring to that color—however you define it.



"Amiga Math Graphics" creates these graceful shapes with short routines based on polar functions.

To use PALETTE, imagine that you have three cans of paint: one red, one green, and one blue. By mixing various portions of these cans together, you can create almost any conceivable color. For example, to make a bright red, take 90 percent of the paint in the red can and mix it with 20 percent of the paint in the green can (you don't need any blue). By coincidence, this is just the way the PALETTE statement works. The statement PALETTE 5,.90,.20,0 assigns a bright red color to color 5. (Strictly speaking, color mixing in Amiga BASIC is more like mixing colors of *light* than colors of paint. Thus, the statement PALETTE 5, 1, 1, 1 sets red, green, and blue to maximum intensity, creating a white color. If you mix red, green, and blue pigments of equal intensities, the result is a very dark brown or black.)

SpiralCone. Using a method similar to Multilobe, this routine multiplies the theta value by 3, resulting in a six-lobed figure. However, only the x coordinate for this figure is used. The y coordinate is calculated using the normal value of theta. A conelike shape is formed by drawing all lines from the center of the display to the calculated points.

SideSpiralCone. This is merely SpiralCone drawn sideways, with different scaling values. The difference in appearance is substantial enough to prevent most viewers from detecting the similarities.

The last two routines in the program rely on similar functions, but produce patterns that look very different on the screen.

Circles. This routine defines a small circle surrounded by a larger one; then it picks 6 equally spaced points on the inner circle. The final design is created by drawing a line from each of those points to 20 or so equally spaced points on the outer circle.

Spikes. Although this routine looks nearly identical to Circles, the shape it draws is completely different.

There's A System To This

You can enjoy and experiment with this program without understanding the math that underlies the graphics. For those who are interested, here's a further explanation of how it works.

In the field of mathematics, there are many systems for expressing the location of a point in a plane. Generally, the center of the system is referred to as the *origin*. The origin is simply a reference point; the location of all other points is defined with respect to the origin.

Most people are familiar with the Cartesian coordinate system, in which the location of any point is expressed in terms of x and y coordinates. The x value represents the point's horizontal distance from the point of origin. Similarly, the y coordinate represents the point's vertical distance from the origin.

The Cartesian system works well for representing two- and three-dimensional shapes on a two-dimensional surface such as the computer's display screen. However, the *polar* coordinate system is much more convenient when you're using trigonometric functions such as sine and cosine. In this scheme, a point's location is expressed as a distance from the origin (conventionally labeled R) and an angle (usually labeled *theta*, or with the Greek letter θ) from a reference line.

Polar Functions

The routines in this program are all based on polar functions. Since Amiga BASIC commands use Cartesian coordinates (roughly—see below), it's necessary to convert from polar to Cartesian coordinates. In general, this operation can be performed by the expressions X=R*COS(theta) and Y=R*SIN(theta).

There are a few difficulties in adapting the graph of a polar function to a computer display. The easiest problem to allow for is the fact that most graphics displays (including the Amiga's) use an upside-down Cartesian system: That is, a point's y coordinate specifies how far *down* the screen the point lies—the exact opposite of the normal Cartesian system. Since all of our shapes are vertically symmetrical, this problem can simply be ignored.

Another difficulty arises because the Amiga's display does not allow for negative coordinates. The Amiga's origin point is in the upper left corner of the screen, not the center of the viewing area as in the Cartesian system. This can easily be corrected by considering the middle of the display to be the origin. In the calculations, all this involves is adding an x and y offset to the points you wish to plot.

Amiga Math Graphics

```
MathGraphics:
GOSUB Initialize
' Repeat until the user presses
a key.
WHILE INKEY$=""
' Module 1:RightOvals
```

```
R1=150
R2=25
R3=25
R4=85
Inc=Pi/64
FOR Theta=0 TO 2*TwoPi STEP Inc
X1=FNPolarX(R1,Theta)
Y1=FNPolarY(R2,Theta)
X2=FNPolarX(R3,Theta+Pi)
Y2=FNPolarY(R4,Theta+Pi)
LINE(X2,Y2)-(X1,Y1),INT(RND*31)+
1
NEXT
Pause
' Module 2:SideOvals--
' Same thing, only different.
R1=150
R2=35
R3=65
R4=85
Inc=Pi/64
Offset=Pi/3
FOR Theta=0 TO 3*TwoPi STEP Inc
X1=FNPolarX(R1,Theta)
Y1=FNPolarY(R2,Theta)
X2=FNPolarX(R3,Theta+Offset)
Y2=FNPolarY(R4,Theta)
LINE(X1,Y1)-(X2,Y2),INT(RND*31)+
1
NEXT
Pause
' Module 3:Twisted8and
' Yet another variation on the d
ouble oval theme.
R1=150
R2=35
R3=65
R4=85
Inc=Pi/64
Offset=Pi/3
FOR Theta=0 TO 3*TwoPi STEP Inc
X1=FNPolarX(R1,Theta)
Y1=FNPolarY(R2,Theta)
X2=FNPolarX(R3,Theta)
Y2=FNPolarY(R4,Theta+Offset)
LINE(X1,Y1)-(X2,Y2),INT(RND*31)+
1
NEXT
Pause
' Module 4:Multilobe
R1=100
Inc=Pi/128
Lobes=4
FOR Theta=0 TO 2*TwoPi STEP Inc
R2=R1*SIN(Lobes*Theta)
X1=FNPolarX(R2,Theta)
Y1=FNPolarY(R2,Theta)
LINE (XCenter,YCenter)-(X1,Y1),I
NT(RND*31)+1
NEXT
Pause
' Module 5:SpiralCone
R1=100
R2=85
Inc=Pi/160
Lobes=3
FOR Theta=0 TO 2*TwoPi STEP Inc
X1=FNPolarX(R1,Theta*Lobes)
Y1=FNPolarY(R2,Theta)
LINE (XCenter,YCenter)-(X1,Y1),I
NT(RND*31)+1
NEXT
Pause
' Module 6:SideSpiralCone
R1=130
R2=80
Inc=Pi/160
Lobes=3
FOR Theta=0 TO 2*TwoPi STEP Inc
X1=FNPolarX(R1,Theta)
Y1=FNPolarY(R2,Theta*Lobes)
LINE (XCenter,YCenter)-(X1,Y1),I
NT(RND*31)+1
NEXT
Pause
' Module 7:Circles
R1=115
R2=85
R3=40
R4=45
Inc1=Pi/3
Inc2=Pi/20
FOR Theta1=0 TO TwoPi STEP Inc1
FOR Theta2= 0 TO TwoPi STEP Inc2
X1=FNPolarX(R1,Theta2)
Y1=FNPolarY(R2,Theta2)
X2=FNPolarX(R3,Theta1)
Y2=FNPolarY(R4,Theta1)
LINE (X1,Y1)-(X2,Y2),INT(RND*31)
+1
NEXT
NEXT
Pause
' Module 8:Spikes
R1=115
R2=85
R3=40
R4=45
Inc1=Pi/3
Inc2=Pi/18
FOR Theta1=0 TO TwoPi STEP Inc1
FOR Theta2= 0 TO TwoPi STEP Inc2
X1=FNPolarX(R1,Theta2)
Y1=FNPolarY(R2,Theta1)
X2=FNPolarX(R3,Theta1)
Y2=FNPolarY(R4,Theta2)
LINE (X1,Y1)-(X2,Y2),INT(RND*31)
+1
NEXT
NEXT
Pause
WEND
' Shut everything down and quit.
WINDOW CLOSE 2
SCREEN CLOSE 2
WINDOW OUTPUT 1
END
SUB Pause STATIC
FOR Delay=1 TO 5000
NEXT
CLS
END SUB
Initialize:
' Set up a 32 color low-res scre
en.
SCREEN 2,320,200,5,1
WINDOW 2,"AmigaBASIC Graphics",(
0,0)-(297,185),23,2
CLS
' Color 0 (background) is black.
PALETTE 0,0,0,0
' Set up the other 31 colors as
random combinations.
FOR L=1 TO 31
PALETTE L,RND,RND,RND
NEXT
' Keep the random sequence rando
m.
RANDOMIZE TIMER
' Define constants.
Pi=3.14159
TwoPi=2*Pi
XCenter=151
YCenter=93
' Define polar to Cartesian conv
ersion functions.
DEF FNPolarX(R,Theta)=R*COS(Thet
a)+XCenter
DEF FNPolarY(R,Theta)=R*SIN(Thet
a)+YCenter
RETURN
```

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Atari Fractal Dragons

Dennis E. Hamilton

Few programs have spawned as much reader interest in recent months as Paul Carlson's fractal graphics routines, published in the March 1986 issue of COMPUTE!. *These translations for eight-bit Atari computers provide valuable insight into how well-written BASIC programs can achieve good performance without the need for machine language routines.*

Here are two Atari BASIC programs that draw fascinating images based on fractal curves. The subject of fractals has been discussed in two previous articles: "IBM Fractal Graphics," by Paul Carlson (COMPUTE!, March, 1986), and "MODified Shapes For Atari ST," by Robert Geiger (COMPUTE!, August, 1986). This article allows owners of eight-bit Atari computers to explore fractal graphics as well. Programs 1 and 2 are written entirely in BASIC, so they're both easy to modify. Type in and save both programs.

Both programs draw the same shape, but at very different speeds (Program 2 is faster). The result in both cases is a complex pattern which resembles an abstract, Oriental dragon (see photo). You can enjoy the designs without understanding the math involved. However, by examining the programs you can learn something about efficient BASIC programming as well as the mathematical principles that underlie the code.

Program 1 shows, in lines 200–410, the simplicity of the edge-drawing procedure. The behavior of the dragon curve is related to the patterns of binary bits that arise as a counter is advanced from all 0's, in single increments, up to all 1's. The way that the curve contains nested, miniature versions of itself is directly related to the way the lowest-order bits repeat cyclically while we step a binary counter through its entire range. A dragon curve is generally created in one of two ways: either by breaking up existing segments to fill up space, or by keeping a counter to pace off the course.

The speed of Program 1 is governed by how fast we increment the binary counter in the SN( ) array. Lines 400–410 provide a very quick solution. Note that it's not necessary to inspect the entire counter to establish the direction of the next move. The change in direction is determined by the binary bit just beyond where the highest carry lands. Line 410 makes that adjustment too; lines 210–220 keep the transformed direction value in the correct range.

These improvements, along with efficient use of tables and FOR-NEXT control, produce curves at a rate that is almost pleasant to watch, down to a mesh interval of two pixels. Program 1 draws each finer curve on top of its predecessor so that you can observe the nesting of patterns. Program 2 works differently, plotting only the endpoints of segments, instead.

Brains Over Muscle

Program 1 performs reasonably well, but is still quite slow at maximum resolution. Program 2 draws exactly the same pattern, but at much higher speed. Both programs use the same line-numbering scheme so that you can identify the program changes precisely.

The second program takes advantage of a technique known as *loop unwinding*. Instead of counting by ones, as in the first program, Program 2 advances the counter in steps of eight. For each eight-step counter increment, the eight required one-moves are performed immediately, one after the other. This approach works well because of the dragon curve's relationship to counting. Each time the three lowest bits of the dragon curve "odometer" step through the eight binary values from 000 to 111, the program performs the same fundamental pattern of *relative* direction changes. Lines 300–370 play out that pattern, including certain other simplifications made possible because we now know precisely what the three lowest counter bits would have been at each step.

Although it uses no machine language routines, Program 2 shows a dramatic increase in efficiency over Program 1. Not every fractal-tracing problem can be solved so easily, but these programs demonstrate one case where brains, in the form of careful logic, can achieve nearly as much as the

muscle of machine language.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

Program 1. Fractals As Counting

```
NG 30  GRAPHICS 8:CDLDR 1
EM 40  DIM SN(14),SX(3),SY(3)
NP 50  FOR I=0 TO 3:READ D:SX
       (I)=D:READ D:SY(I)=D:N
       EXT I
DK 60  DATA 128,0,0,128,-128,
       0,0,-128
OC 100 N2=0:POKE 752,1
LF 110 SETCDLDR 2,N2,2:SETCD
       LDR 1,0,12:N2=N2+1:NC
       =2*N2:NP=NC-1
LN 120 IF NC>12 THEN POKE 75
       2,0:END
ON 125 POKE 77,0:REM Defer A
       ttract Mode
IP 130 FOR I=0 TO 3:SX(I)=SX
       (I)/2:SY(I)=SY(I)/2:N
       EXT I
KH 140 POKE 656,0:POKE 657,5
       :PRINT "ATARI Fractal
        Dragons  Mesh ";SX(0
       );"  "
FB 150 X=100:Y=96:PLOT X,Y
PK 160 FOR C=0 TO NC:SN(C)=0
       :NEXT C
AP 200 FOR D=4-N2 TO 100
CN 210 IF D>3 THEN D=D-4
CG 220 IF D<0 THEN D=D+4
GI 300 X=X+SX(D):Y=Y+SY(D):D
       RAWTO X,Y
GK 400 FOR C=0 TO NP:IF SN(C
       )>0 THEN SN(C)=0:NEXT
        C:GOTO 110
AO 410 SN(C)=1:D=D-2*SN(C+1)
       :NEXT D
```

Program 2. Counting In Blocks

```
NG 30  GRAPHICS 8:CDLDR 1
YM 40  DIM SN(14),SX(12),SY(1
       2)
PP 50  FOR I=0 TO 12:READ D:S
       X(I)=D:READ D:SY(I)=D:
       NEXT I
GC 60  DATA 32,0,0,32,-32,0,0
       ,-32
GD 70  DATA 32,0,0,32,-32,0,0
       ,-32
GE 80  DATA 32,0,0,32,-32,0,0
       ,-32
EE 90  DATA 32,0
QE 100 N2=2:POKE 752,1
BD 110 SETCDLDR 2,N2-1,2:SET
       CDLDR 1,0,12:N2=N2+1:
       NC=2*N2:NP=NC-1
LP 120 IF NC>14 THEN POKE 75
       2,0:END
ON 125 POKE 77,0:REM Defer A
       ttract Mode
LP 130 FOR I=0 TO 12:SX(I)=S
       X(I)/2:SY(I)=SY(I)/2:
       NEXT I
KH 140 POKE 656,0:POKE 657,5
       :PRINT "ATARI Fractal
        Dragons{3 SPACES}Mes
       h ";SX(0);"  "
FB 150 X=100:Y=96:PLOT X,Y
PK 160 FOR C=0 TO NC:SN(C)=0
       :NEXT C
BD 200 FOR D=8-N2 TO 100
DA 210 IF D>7 THEN D=D-4
CK 220 IF D<4 THEN D=D+4
NG 300 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
LJ 305 D=D+1
NH 310 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
JA 320 X=X+SX(D+1):Y=Y+SY(D+
       1):PLOT X,Y
NJ 330 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
GK 335 D=D+1-2*SN(3)
NK 340 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
JD 350 X=X+SX(D+1):Y=Y+SY(D+
       1):PLOT X,Y
NN 360 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
NB 365 D=D-1
NN 370 X=X+SX(D):Y=Y+SY(D):P
       LOT X,Y
GN 400 FOR C=3 TO NP:IF SN(C
       )>0 THEN SN(C)=0:NEXT
        C:GOTO 110
AO 410 SN(C)=1:D=D-2*SN(C+1)
       :NEXT D
```


Boot 64 For 128

Mike Tranchemontagne

Most Commodore 128 owners know that their computer can automatically load and run any 128 program from disk. This easy-to-use program adds the same convenience for Commodore 64 programs as well, allowing the 128 to load and run any 64 program automatically when you boot the system. A disk drive is required.

The Commodore 128 has many outstanding features, not the least of which is its ability to run thousands of excellent Commodore 64 programs and games. The 128 can automatically load and run any program written for 128 mode or CP/M mode. Although there are programs for the 64 that automatically run after loading from disk, it's still necessary to type in a command like LOAD "PROGRAM",8,1 to activate the disk drive in 64 mode. "Boot 64 For 128" automates this process so that you can load and run any Commodore 64 program simply by putting the disk in the drive and turning on the computer. This feature is ideal for younger members of the family or infrequent computer users. Even experienced programmers will appreciate the extra convenience it affords.

Creating An Autoboot Disk

Type in Programs 1, 2, and 3, and save copies of all three programs.

For the boot sector created by Program 2 to work properly, you must use the filename 128BOOT64 when saving Program 1. To create an autobooting disk for 64 mode, follow these three steps:

1. Select the disk which will contain the 64 program you want to load and run automatically. Load Program 2, insert the disk in the drive, and run the program. When Program 2 is finished, the disk contains a 128 boot sector that will cause the computer to load and run a program named 128BOOT64. (You do not need to save Program 2 on the target disk.)

2. Load Program 1 and save it on the disk. Remember, you *must* save this program with the filename 128BOOT64.

3. Load the 64 program which you want to load and run automatically; then save it on the disk using the filename BOOT64. You *must* save the program with this filename.

Once you've performed all three steps, place the disk in the drive and reboot by turning the power off and on or by pressing the reset switch. If the computer does not load and run the desired program, check Programs 1 and 2 for typing errors and repeat the process. Keep in mind that the process won't work unless you use the filenames noted above.

Autobooting ML Programs

With this technique, you can load and run any Commodore 64 BASIC program. The same is true of any machine language program that runs like BASIC. For instance, *SpeedScript*, COMPUTE!'s word processor, ordinarily starts with LOAD"SPEEDSCRIPT",8 and RUN. To autoboot and run *SpeedScript*, simply save *SpeedScript* to disk with the filename BOOT64 as described in Step 3.

You can also autoboot and start a machine language program that normally loads with ,8,1 and starts with SYS instead of RUN. Program 3 is a very short BASIC loader which loads an ML program into memory, then activates it with SYS. As listed, the program loads and starts DOS 5.1, the DOS Wedge program supplied on the 1541/1571 Test/Demo disk. To load a different ML program, replace the name DOS 5.1 in line 20 with the filename of your program, and replace the address 52224 in line 30 with the correct SYS address for the program. When that's done, perform steps 1 and 2 as described earlier; then save Program 3 on the disk with the filename BOOT64. Of course, you must also copy the ML program to the same disk, using the filename you specified in line 20 of Program 3.

How Autobooting Works

When you turn on the 128 (or reboot by pressing the reset button), the computer automatically performs several checks to determine which mode it will operate in. If an autostart cartridge is plugged into the cartridge port, the cartridge takes control. If the Commodore key is pressed, the computer enters 64 mode. If the STOP key is pressed, the 128 enters the built-in machine language monitor.

If none of these conditions applies, the 128 looks on sector 0 of track 1 of the current disk (known as the *boot sector*) to see whether it contains a boot header. If no boot header is found, the computer simply starts BASIC, which produces the familiar READY prompt. However, if the boot header information is present, the 128 automatically loads and runs the program indicated in the boot sector. This process works equally well with a 1571 or 1541 disk drive.

In 128 mode, the 128 can switch to 64 mode by performing the command GO64. However, there is no provision for loading and running a program after you enter 64 mode. To achieve the same effect, this program creates a boot sector that tells the computer to load and run the program 128BOOT64. That program, in turn, stores a short machine language program and cartridge-identifier bytes in the special memory area where Commodore 64 autostarting cartridges normally reside. The ML program causes the computer (now in 64 mode) to perform a normal reset. When the reset occurs, the computer detects the cartridge-identifier bytes, concludes that a cartridge is present, and runs the ML routine found at the cartridge start address. This program, in turn, uses the dynamic keyboard technique to load and run a program named BOOT64 from disk. The process may seem complicated, but it all happens very quickly, and you need not understand the details in order to take advantage of it.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

Program 1: 128BOOT64

```
EP 10 A=32768: PRINT "(SWITCH
      {SPACE}TO 40 COLUMN DISP
      LAY)"
XK 20 READ D$: IF D$="-1" THEN
       GO64
HR 30 POKE A,DEC(D$):A=A+1: GO
      TO 20
PH 40 DATA 09,80,5E,FE,C3,C2,C
      D,38,30
HM 50 DATA 8E,16,D0,20,A3,FD,2
      0,50,FD
QX 60 DATA 20,15,FD,20,5B,FF,5
      8
QH 70 DATA 20,53,E4,20,BF,E3,2
      0,22,E4
CQ 80 DATA A2,F8,9A
PH 90 DATA A2,00,BD,41,80,F0,0
      6
AK 100 DATA 20,D2,FF,E8,D0,F5
HA 110 DATA A9,0D,8D,77,02,8D,
       78,02
FG 120 DATA A9,02,85,C6
JA 130 DATA 4C,74,A4
BR 140 DATA 0D,4C,4F,41,44,22,
       42,4F,4F,54,36,34,22,2C
       ,38
BQ 150 DATA 0D,0D,0D,0D,0D,52,
       55,4E,91,91,91,91,91,91
       ,91,0,-1
```

Program 2: Boot Sector Maker

```
RJ 10 REM PROGRAM 2, CREATE BO
      OT SECTOR FOR 128BOOT64
JF 20 DCLEAR: OPEN 15,8,15: OP
      EN 2,8,2,"#": PRINT# 15,
      "B-P:2,0"
RR 30 READ D$: D=DEC(D$): IF D
      >255 THEN 50
EE 40 PRINT# 2,CHR$(D);: GOTO
      {SPACE}30
RJ 50 PRINT# 15,"U2;2,0,1,0"
SP 60 PRINT DS$: CLOSE 2: CLOS
      E 15
XG 70 DATA 43,42,4D,00,00,00,0
      0,31,32,38,42,4F,4F,54,3
      6,34,00,00,A2,18
RM 80 DATA A0,0B,4C,A5,AF,52,5
      5,4E,22,31,32,38,42,4F,4
      F,54,36,34,00,100
```

Program 3: ML Loader

```
PM 10 REM C64 ML PROG LOADER E
      XAMPLE
KM 20 IF A=0 THEN A=1: LOAD "D
      OS 5.1",8,1
QE 30 SA=52224: REM START ADDR
      ESS
KH 40 SYS SA
```

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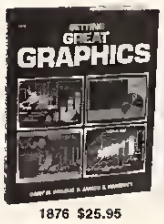

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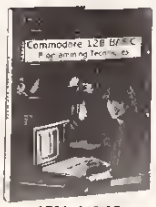

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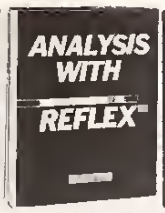

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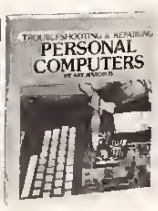

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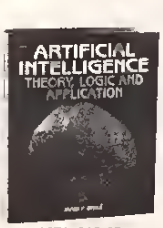

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High-Speed String Sort For Atari BASIC

Everett Hutchison

Inspired by a previous COMPUTE! *utility for Atari, this routine sorts strings with the lightning speed of machine language, yet it can be added to any BASIC program.*

A recent article in COMPUTE! illustrated how to add a machine language search routine to Atari BASIC (see "High-Speed String Search for Atari BASIC," February, 1986). Another handy utility is the high-speed string sort, which can organize strings in a database, mailing list program, and the like.

The high-speed sort routine presented here is written in relocatable machine language, which means it can be added to any BASIC program without fear of memory conflicts. And it's fast—up to 900 times faster than BASIC. In the worst case, for instance, a BASIC bubble sort routine might take as long as five hours to sort 1000 strings. This routine can do it in 20 seconds.

Atari BASIC does not allow string arrays, so this sort works a little differently from those intended for other BASICs. All of the strings to be sorted are stored in one giant string. This string can have any legal string name. The sorted strings are actually substrings of the larger string.

The program demonstrates how to use the sort routine from BASIC. It creates and sorts 100 strings. Before calling the routine, you must DIMension a string 256 characters in length (see BUFFER$ in line 10). The sort routine uses this string as a buffer. You must also POKE the starting address of the string into locations 232–233 (line 100). Call the routine with the following statement:

```
SORT=USR(ADR(SORT$),L,A,B,C,D,E,F)
```

The call to the sort routine includes seven variables. Here's an explanation of the variables used in the example statement:

L length of each record
A address of the beginning of the array to sort
B ending address of the last record; this can be calculated by taking the start address of the string and adding the number of records times the record length
C starting address of the last record; this works out to B−L
D address of the buffer string
E start of the search field within a record (beginning at 0)
F end of the search field within a record

For instance, say that each record contains a name in its first ten characters and an age in the last two, and both fields are padded out with spaces as needed. To sort the names alphabetically, you would set the start of the search field to 0 and the end of the search field to 9. To sort the ages numerically, you would set the start of the search field to 10 and the end of the search field to 11.

The demonstration program creates 100 random strings, each of which is ten characters long. After the strings have been created, they are displayed on the screen. Once this is done, the program waits for a keypress and then sorts the strings. The strings are displayed again when the sorting is complete.

High-Speed String Sort

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
JA 10 DIM SORT$(169),BUFFER$
      (256)
CB 20 FOR I=1 TO 169:READ A:
      SORT$(I,I)=CHR$(A):NEX
```

```
      T I
JA 30 NR=100:RECLEN=10:DIM T
      $(RECLEN),MASTER$(NR*1
      0)
EO 40 PRINT "{CLEAR}CREATING
       RANDOM STRINGS":POKE
      752,1
EA 50 FOR A=1 TO NR:FOR B=1
      TO 10:T$(B,B)=CHR$(65+
      RND(1)*25):NEXT B:PRIN
      T A;"{UP}"
OF 60 MASTER$((A-1)*10+1,A*1
      0)=T$:NEXT A
FJ 70 PRINT "{CLEAR}":FOR A=
      1 TO NR:PRINT MASTER$(
      (A-1)*10+1,A*10):NEXT
      A
LK 80 PRINT "{CLEAR}{DOWN}PR
      ESS ANY KEY TO SORT":G
      OSUB 150:PRINT "{DOWN}
      SORTING"
KI 90 L=RECLEN:A=ADR(MASTER$
      ):B=A+NR*RECLEN:C=B-RE
      CLEN:D=ADR(BUFFER$):E=
      0:F=9
PK 100 ADDR=41+ADR(SORT$):HB
       YTE=INT(ADDR/256):LBY
       TE=ADDR-256*HBYTE:POK
       E 232,LBYTE:POKE 233,
       HBYTE
AL 110 SORT=USR(ADR(SORT$),L
       ,A,B,C,D,E,F)
CH 120 PRINT "{DOWN}DONE":PR
       INT "{DOWN}PRESS ANY
       KEY TO SEE STRINGS":G
       OSUB 150
PO 130 FOR A=1 TO NR:PRINT M
       ASTER$((A-1)*10+1,A*1
       0):NEXT A
MP 140 POKE 752,0:END
CO 150 POKE 764,255
NM 160 IF PEEK(764)=255 THEN
        160
HI 170 RETURN
FI 180 DATA 104,104,104,133,
       240,104,133,242,133,2
       44,104,133,241,133,24
       3,104,133,246,104,133
       ,245,104,133,248,104,
       133
PE 190 DATA 247,104,133,250,
       104,133,249,104,104,1
       33,230,104,104,133,23
       1
KG 200 DATA 165,242,133,252,
       165,241,133,251
EM 210 DATA 24,165,241,101,2
       40,133,241,144,2,230,
       242
FJ 220 DATA 165,242,197,246,
       208,6,165,241,197,245
       ,240,29,164,230,177,2
       41
BO 230 DATA 209,251,240,13,1
       76,223,165,242,133,25
       2,165,241,133,251,24,
       144,212,200,196,231,2
       40,207,24,144,229
GH 240 DATA 160,0,177,251,14
       5,249,200,196,240,208
       ,247,160,0,177,243,14
       5,251,200,196,240,208
       ,247,160,0,177,249
OL 250 DATA 145,243,200,196,
       240,208,247
FH 260 DATA 24,165,243,101,2
       40,133,243,144,2,230,
       244
MC 270 DATA 165,244,197,248,
       208,7,165,243,197,247
       ,208,1,96,165,244,133
       ,242,165,243,133,241,
       108,232,0
```


TurboDisk For DOS 3.3

R. Ellerbrock

This short utility allows Apple II owners to load DOS 3.3 files up to three times faster than usual. Although it's written in machine language, the program is easy for anyone to use, even if you're not familiar with machine language programming. A disk drive is required; the program runs only under DOS 3.3.

The Apple II disk drive is one of the faster 5¼-inch drives in the microcomputer world, but even a fast drive seems slow at times. "TurboDisk for DOS 3.3" turbocharges your Apple II disk drive under DOS 3.3, allowing it to load, save, and perform other operations up to three times faster than normal. No special knowledge is needed to take advantage of the program. Once the enhanced DOS is installed on disk, every disk operation (except INIT—see below) speeds up dramatically.

TurboDisk is written entirely in machine language, so you must enter it with the "Apple MLX" machine language entry program found elsewhere in this issue. Follow the MLX directions carefully as you type in the program. When you run MLX, you'll be asked for a starting address and an ending address for the data you will be entering. Here are the addresses you need for TurboDisk:

Starting address: 2000
Ending address: 23FF

TurboDisk works by altering the DOS images ordinarily found on the disk. To create the faster version of DOS, type BRUN TURBODISK and press Return (replace TURBODISK with whatever filename you used when you saved TurboDisk data to disk using MLX). TurboDisk displays a menu offering two choices. Press 1 to install the turbocharged DOS on disk, or press 2 to exit.

When you press 1, TurboDisk prompts you to insert the desired disk in the drive. This disk must be formatted and must contain a working copy of DOS 3.3. Because this program alters the DOS information on the disk, *do not use TurboDisk on your master copy of DOS 3.3.* Always keep a copy of the original DOS 3.3 in a safe place for future use, and use TurboDisk only on other disks. After the disk is in place, press Return to continue. If you change your mind, press Esc to abort the operation.

When you press Return, TurboDisk installs the enhanced DOS on the disk. If an error occurs at this stage (the drive door is left open, for example), TurboDisk lets you try again by pressing Return a second time. If the error cannot be cured, press Esc to abort the program.

Once the new DOS is in place, all disk operations except for INIT occur at enhanced speeds. The table indicates the number of seconds it takes to load an assortment of commercial programs at normal speed

and with TurboDisk.

Program	Normal speed	With TurboDisk
Moonpatrol	31	7
DOS Boss	16	5
Frogger	34	7
Night Crawler	32	15

The only real limitation of this program is that it's impossible to initialize a disk at enhanced speeds. If you enter INIT when TurboDisk is active, nothing happens (that command is deliberately disabled). To initialize a disk, you must reboot with a normal DOS 3.3 disk.

Inside TurboDisk

When you BRUN TurboDisk, it copies two pages (512 bytes) of data to two previously unused sectors in the DOS image (track 0, sector A, and track 0, sector B). When you boot with the disk, the computer loads the contents of these two sectors in addition to the normal DOS data. Finally, TurboDisk loads the contents of track 0, sector C into memory, changes three bytes, then rewrites the sector to disk.

Under normal circumstances, DOS jumps to location $9D84 when it's finished loading to perform a cold start. TurboDisk inserts a JMP (JuMP) instruction at location $9D84 which redirects control to the code at location $9B04. This code copies new data into the RWTS (Read/Write Track/Sector) area of memory. In the RWTS area are a few bytes that contain the arm move delay table. To speed disk access, we simply change the contents of the delay table bytes. Once this is done, TurboDisk restores the original address at location $9D84 and proceeds with a cold start as usual.

TurboDisk For DOS 3.3

Please refer to the "Apple MLX" article in this issue before entering the following listing.

```
START ADDRESS:  2000
END ADDRESS:    23FF

2000: 4C 47 20 20 E3 03 B4 00 72
2008: B5 01 A5 02 A0 04 91 00 58
2010: A5 03 C9 10 90 04 A9 00 06
2018: 85 03 A0 05 91 00 A0 08 16
2020: A9 00 91 00 C8 A9 10 91 06
2028: 00 A5 04 A0 0C 91 00 A9 AC
2030: 00 A0 03 91 00 20 E3 03 5D
2038: 20 D9 03 A9 00 85 48 90 31
2040: 05 A9 87 4C 70 20 60 20 08
2048: 58 FC A2 0C 20 4A F9 A0 C7
2050: 00 B9 47 21 C8 20 ED FD 9A
2058: C0 3B D0 F5 20 0C FD C9 3B
2060: B1 D0 06 20 B1 20 4C 5C F1
2068: 20 C9 B2 D0 EF 4C D0 03 E3
2070: A0 00 B9 B7 21 CB 20 ED 0B
2078: FD C0 0F D0 F5 4C 9B 20 0F
2080: 60 A0 00 B9 9B 21 CB 20 AF
2088: ED FD C0 19 D0 F5 AD EA BD
2090: B7 4A 4A 4A 4A 1B 69 B1 64
2098: 20 ED FD 20 0C FD C9 9B AD
20A0: F0 03 20 00 21 4C 47 20 07
20A8: 00 00 00 00 00 00 00 00 EB
20B0: 00 00 00 00 00 00 00 00 F0
20B8: 00 00 00 00 00 00 00 00 FB
20C0: 00 00 00 00 00 00 00 00 01
20C8: 00 00 00 00 00 00 00 00 09
20D0: 00 00 00 00 00 00 00 00 11
20D8: 00 00 00 00 00 00 00 00 19
20E0: 00 00 00 00 00 00 00 00 21
20E8: 00 00 00 00 00 00 00 00 29
20F0: 00 00 00 00 00 00 00 00 31
20F8: 00 00 00 00 00 00 00 00 39
2100: A9 22 BD 26 20 A9 0A B5 F4
2108: 03 A9 00 B5 02 A9 02 B5 CE
2110: 04 20 03 20 A9 23 BD 26 D9
2118: 20 A9 0B B5 03 20 03 20 4D
2120: A9 10 BD 26 20 A9 0C B5 94
2128: 03 A9 01 B5 04 20 03 20 95
2130: A9 4C BD B4 10 A9 04 BD 11
2138: B5 10 A9 9B BD B6 10 A9 B0
2140: 02 B5 04 20 03 20 60 46 07
2148: 41 53 54 A0 4C 4F 41 44 FA
2150: 49 4E 47 A0 44 4F 53 BD 51
2158: BD BD BD BD BD BD BD BD 9A
2160: 31 AE A0 D5 D0 C4 C1 D4 4A
2168: C5 A0 C1 A0 C4 C9 D3 CB BB
2170: BD BD 32 AE A0 D1 D5 C9 CF
2178: D4 BD BD C3 CB CF CF D3 6F
2180: C5 A0 00 00 00 00 00 8D 5B
2188: BD BD BD 46 41 54 41 4C 35
2190: A0 45 52 52 4F 52 00 00 A7
2198: BD BD 8D BD C9 CE D3 C5 B6
21A0: D2 D4 A0 C4 C9 D3 CB A0 B7
21A8: C9 CE A0 C4 D2 C9 D6 C5 15
21B0: A0 00 00 00 00 00 00 00 43
21B8: 00 00 00 00 00 00 00 00 FA
21C0: 00 00 00 00 00 00 00 00 03
21C8: 00 00 00 00 00 00 00 00 0B
21D0: 00 00 00 00 00 00 00 00 13
21D8: 00 00 00 00 00 00 00 00 1B
21E0: 00 00 00 00 00 00 00 00 23
21E8: 00 00 00 00 00 00 00 00 2B
21F0: 00 00 00 00 00 00 00 00 33
21F8: 00 00 00 00 00 00 00 00 3B
2200: 00 00 00 00 A2 6D BD 39 C3
2208: 9B 9D 56 BC CA 10 F7 A2 41
2210: 20 BD A7 9B 9D DF BC CA 33
2218: 10 F7 A2 2C BD C7 9B 9D 5B
2220: 69 BA CA 10 F7 A2 DB BD E1
2228: EF 9B 9D AE 8E CA D0 F7 A4
2230: A9 60 8D 4F A5 4C C2 9C BB
2238: 00 A9 BC 8D 84 A3 A9 7E DB
2240: BD B3 A3 A9 4C BD 82 A3 7C
2248: A9 BC BD 49 A4 A9 70 BD 11
2250: 4B A4 60 A5 67 8D 72 AA 49
2258: A5 6B BD 73 AA A9 02 D0 43
2260: 05 20 7A A4 A9 04 8D E9 28
2268: BC BD CC BE BD 42 BF BD 76
2270: AC BC AD 60 AA BD 55 BF EB
2278: AD 61 AA 8D 56 BF AD 72 99
2280: AA 8D 57 BF AD 73 AA 8D B2
2288: 5B BF AD 55 8F 1B 69 04 29
2290: 8D 55 BF AD 56 8F 69 00 48
2298: 8D 56 8F A9 00 8D F3 B7 A1
22A0: BD EB B7 4C DF BC 00 A9 FD
22A8: 01 BD F4 B7 AD 57 8F 3B 6D
22B0: E9 04 8D D1 BE BD F0 87 7F
22B8: 8D 57 BF AD 58 BF E9 00 02
22C0: 8D F1 87 4C 69 BA 00 8D C7
22C8: D2 BE 8D 5B 8F AD C9 B5 58
22D0: 8D F0 BE 8D F9 BE BD 18 C9
22D8: BF BD 14 8F AD CA B5 BD 70
22E0: F1 BE BD FA BE 8D 1C BF 53
22E8: BF 15 8F 4C AF 8E 00 00 B7
22F0: AD CB B5 8D CE BE 8D 44 5F
22F8: BF AD CC B5 8D CF 8E 8D 34
2300: 45 BF AD 56 8F F0 6F A9 3E
2308: 00 BD 42 BF A2 04 BD 00 96
2310: 96 9D 00 20 EB D0 F7 A2 2B
2318: 0E BE FF B7 AE FF B7 F0 5A
2320: 79 EE 58 BF CE 56 BF F0 26
2328: 2B AD 56 BF C9 FF F0 60 C6
2330: BD 00 97 F0 5B BD EC B7 F9
2338: EB BD 00 97 BD ED B7 EB 5B
2340: BE FF B7 EE F1 B7 A0 EB 4C
2348: A9 B7 20 B5 B7 90 CD A9 F5
2350: 0B 4C D5 A6 BD 00 97 BD 7D
2358: EC B7 EB BD 00 97 BD ED 63
2360: B7 A9 00 AD CC B5 BD F1 12
2368: B7 AD CB B5 BD F0 B7 A9 14
2370: B7 A0 EB 20 B5 B7 AD 57 19
2378: BF BD 47 BF AD 5B BF BD C2
2380: 4B BF A2 04 BD 00 96 9D 2B
2388: 00 20 EB EC 55 BF D0 F4 03
2390: A9 00 A8 91 40 60 55 BF C7
2398: 57 BF A9 0B BD D5 B5 A2 02
23A0: 0C BD EB B7 9D B0 BF CA 2E
23A8: 10 F7 3B 20 5E AF A2 0C 01
23B0: BD B0 BF 9D EB B7 CA 10 93
23B8: F7 A2 0C BE FF B7 4C E0 66
23C0: BE 00 A2 03 BD D3 9C 9D FE
23C8: B3 9D CA D0 F7 20 56 BC 4B
23D0: 4C B4 9D 00 AD E9 B7 00 96
23D8: 00 00 00 00 00 00 00 00 1F
23E0: 00 00 00 00 00 00 00 00 27
23E8: 00 00 00 00 00 00 00 00 2F
23F0: 00 00 00 00 00 00 00 00 37
23F8: 00 00 00 00 00 00 00 00 3F
```

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PC Mini-Assembler

Georg Zimmer

Are you interested in learning 8088 machine language for the IBM PC? This clever program takes advantage of the system program DEBUG to create a complete, label-based machine language assembler. The program requires BASICA for the PC, as well as the program DEBUG (included with MS-DOS). Owners of PC-compatibles should check the instructions at the end of this article before typing in the program.

8088 machine language—the "native tongue" of the IBM PC and its compatible computers—is both powerful and comparatively easy to program. The 8088 microprocessor offers many high-level instructions—such as string commands, multiplication, and division—that aren't available with simpler processors such as the 6502. Best of all, the PC operating system contains a large number of software interrupts (built-in routines) which are easy to call from machine language. With interrupts, you can do everything from writing a dot on a graphics screen to opening disk files.

The first tool you need for machine language programming is a convenient, reliable assembler which converts an ASCII file of symbolic instructions—usually called the *source file*—into a file containing object code which the computer can execute directly. "PC Mini-Assembler" is a label-based assembler written entirely in BASIC. Although it's not as powerful as IBM's own assembler or macro assembler, Mini-Assembler provides all the basic features you need to assemble a machine language program on an IBM PC. If you're using a PC-compatible computer, read the special instructions at the end of this article before attempting to use this program.

Getting Started

Type in Program 1 and save it to disk as an ordinary BASIC program. Program 2 is a short assembly language source program which we'll use to demonstrate how PC Mini-Assembler works. Programs 3 and 4 are short INCLUDE files required to assemble Program 2. Use the BASIC editor to type in Programs 2–4. Although these are not BASIC programs, we have listed them with the usual IBM Proofreader checksums; if you type these programs with a word processor or text editor, do not include the checksums. Programs 2–4 *must* be stored as ASCII files, not as tokenized BASIC programs. If you enter them from BASIC, save them to disk as ASCII using the ,A option of SAVE. For instance, this command saves a file in ASCII form with the filename HEXCONV.ASM:

```
SAVE "HEXCONV.ASM",A
```

The filename extension .ASM is a conventional identifier for IBM assembly language source files. You may include this extension for the sake of consistency; however, it is not required for this assembler. You must save Program 3 with the filename STACK.LIB, and save Program 4 with the filename CLS.LIB. Put the source file (Program 2) and the INCLUDE files (Programs 3 and 4) on the disk you will use for the assembly. Before using the assembler, you must also copy the program DEBUG.COM from your DOS disk to the disk that contains the source file.

Once the work disk contains the necessary files, load and run Program 1. The program begins by displaying a directory of all the files on the current disk. Then it asks for the name of the file you wish to assemble. Enter the full filename, including any extension. If the file is not found, the program prints an error message and allows you to reenter the name. Otherwise, the assembly proceeds automatically. Several passes are needed to finish the process, most of which is visible on the screen.

When the assembly is complete, Mini-Assembler prompts you to enter a name for the output file (executable object file). At this

point you can choose to create two different types of files. To create a command (.COM) file, include the extension .COM or .com with the filename. A command file can be executed simply by typing its filename from the DOS prompt. If you do omit the .COM extension, Mini-Assembler assumes that you want to create a file which can be called from BASIC, and creates a file appropriate for that use.

Of course, it's impossible to explain all the details of 8088 assembly language programming in a magazine article. I learned about the subject from *COMPUTE's Beginner's Guide to Machine Language on the PC and PCjr* (available from COMPUTE! Books). Many other good texts are also available.

Pseudo-Ops

An assembly language source file contains two kinds of instructions—opcodes and pseudo-opcodes. What we usually call opcodes are actually *mnemonics*, descriptive names for the binary codes that comprise the actual machine language instruction. The mnemonic RET, for instance, stands for the opcode that performs a RETurn. The function of an assembler is to convert source file mnemonics into an executable series of opcodes.

A pseudo-opcode is an instruction to the assembler rather than a symbolic name for a machine language instruction. Commercial assemblers such as the IBM Macro Assembler permit you to use many different pseudo-ops. PC Mini-Assembler offers a more limited set of assembler directives. Here's a list of all the pseudo-ops the program recognizes.

Origin. The first line in your source code must indicate the starting address for the program. This function is performed by the asterisk (*) pseudo-op. For a PC with at least 96K, use 1C00H for the segment. An offset of zero is best for files that will be BLOADed, but for .COM files, you should use an offset of 0100H, because that's where DOS loads .COM files. Here are two typical origin directives:

```
10 * 1C00:100 ;  .COM file
10 * 1C00:0 ;    BLOAD file
```

Symbol Definitions. Assembly language programs normally use symbolic names to refer to program variables and labels (addresses within the program). The period (.) pseudo-op tells the assembler that the preceding string is a symbolic label or variable. Symbols may contain spaces. You may have a symbol alone on a line, or an instruction or data may follow it:

```
10 VIDEO FUNCTION. INT 10
20 TEST LABEL.
30 MOV AX,VARIABLE
40 JMP TEST LABEL
50 VARIABLE. DB "Hello",0
```

Number Converter. Mini-Assembler assumes that all numbers are expressed in hexadecimal (base 16) notation. The percentage (%) pseudo-op tells the assembler that the following number is decimal, not hexadecimal. When it assembles the program, Mini-Assembler converts the number to hexadecimal. Here are a few examples:

```
100 MOV AH,%64
110 SUB AX,%10
300 DB DUP %10 (%20)
```

Text-To-ASCII Converter. The apostrophe (') pseudo-op changes a single character to its equivalent ASCII code. Do not enclose the character; only one apostrophe is needed:

```
100 MOV DL, 'A
300 MOV BX, 'A
```

Comment. The semicolon (;) allows you to add comments to a program. The assembler ignores everything on the line after the semicolon:

```
10 ;DISK SECURITY PROGRAM
120 MOV CX,%10 ;REPEAT 10d TIMES
```

Forced Label Assignment. The equal sign (=) pseudo-op allows you to create variables that have addresses outside the program. You must specify which segment override the assembler is to use. You should assign all variables at the beginning of the source code. Do not confuse this pseudo-op with the EQU pseudo-op (see below). EQU and = perform similar functions, but = is only for use with variables whose address is outside your program area:

```
10 SCREEN = ES:0
20 STORAGE = DS:80
```

Data Byte. The DB pseudo-op is used to put byte values in a program's data section. When entering ASCII characters as data, enclose them in double quotation marks rather than apostrophes:

```
100 DB "HELLO$"
110 DB "Hello",0,"how are you",0
120 DB DUP %10 ("Hello",0)
```

Data Word. The DW pseudo-op puts word values in the data section of a program. Numbers are stored in low-byte/high-byte format:

```
100 DW AB1E,%1000,FFD2
110 DW %10,%20,%30
```

INCLUDE. The INCLUDE pseudo-op causes the assembler to include a library file from disk as it assembles the main program. INCLUDE files typically contain often-used routines or code segments. Instead of retyping a routine every time you write a new program, you can simply enter it once (using label names that you are not likely to use again), and save it to disk. Library files usually end with the .LIB extension. The example program uses two INCLUDE files: STACK.LIB and CLS.LIB. These files should *not* contain an origin (*) and must be saved in ASCII format, just like the source file. Do not enclose the INCLUDE filename in quotation marks:

```
10 INCLUDE STACK.LIB
20 CALL CLS
90 INCLUDE CLS.LIB
```

EQUate. The EQU pseudo-op equates a value to a constant. The value can be text, a number, or even an instruction:

```
30 BNE     EQU JNZ  ;LEGAL
40 VIDEO   EQU %16  ;LEGAL
```

Note that you cannot use a constant within a constant. The following line is illegal because VIDEO is a constant:

```
50 VIDEO FUNCTION EQU INT VIDEO
```

OFFSET. The OFFSET pseudo-op tells the assembler to return the offset (address) of a variable rather than the value contained in the variable:

```
120 MOV DX,OFFSET MESSAGE
200 MESSAGE. DB"HELLO$"
```

DUPlicate. The DUP pseudo-op tells the assembler to duplicate a DB or DW directive the number of times specified in parentheses. It is often used to create work space. Be sure to include the % sign for decimal numbers, and enclose all text in quotation marks. The assembler may take a long time to perform a

DUP operation that uses a large value (1000H, for instance). Do not use a question mark to signify a value that's unknown at the time of assembly; instead, use a 0:

```
1000 DB DUP 100 (0);256 bytes
1100 BUFFER. DB DUP %16 (" ")
1200 TABLE. DW DUP 3 (1,2,4)
```

Do not try to enclose one DUP within the parentheses of another DUP. For example, the following statement causes an error:

```
1300 DB DUP 8 (DUP 3(0))
```

Assembly Tips

Here are a few tips that will help you get the most out of this program. First, you can speed the assembly process by using a disk that contains only the files you need for Mini Assembler. Program 3 (STACK .LIB) can be INCLUDEd whenever you need to set up your own stack space.

Mini Assembler does not support the ASSUME pseudo-op. Instead, it automatically puts all variables in the code segment of the program. Unless you specify a segment with the = pseudo-op, the assembler automatically precludes all memory addressing instructions (those which use a named variable for an operand) with the CS: override.

Many texts on 8088 machine language state that you should define a program as a far procedure by using the PROC FAR pseudo-op (for a far return to DOS or BASIC). As long as the far-return address has been pushed onto the stack, you can do the same thing by using RETF to exit the program.

Because of the way that DEBUG works (see below), there are two significant differences between Mini-Assembler and the IBM assemblers. First, you cannot use an operand after XLAT or any of the string instructions because DEBUG won't accept those constructions. For instance, use XLAT alone instead of XLAT *source-table* (in this case, *source-table* is implied). Similarly, use REPE MOVS alone rather than REPE MOVS *destination-source* (again, *destination-source* is implied).

Secondly, you cannot use segment overrides in the middle of an instruction. A segment override is actually an instruction in itself, and DEBUG becomes confused when it occurs within another instruction. Thus, use ES:MOV AX,SCREEN instead of MOV AX,ES:SCREEN. With Mini-Assembler, you shouldn't have to worry about segment overrides very often; simply use the = pseudo-op if a variable is outside the program.

Compared to commercial assemblers, Mini-Assembler is exceedingly compact. This is possible because it relies on DEBUG.COM to perform most of the actual work. On the first pass, Mini-Assembler reads the entire source file, replacing labels, constants, and variables with nulls. It creates a work file on disk, pipes this file through DEBUG, and sends DEBUG's output to a second file. Then the program scans the second file, replacing nulls with target addresses. At this point it creates another file, which is piped through DEBUG again. The resulting file is scanned again, and target addresses are changed where necessary. This step is repeated until all the addresses are correct.

Mini-Assembler does not require that you use the LINK program. When it writes the object file to disk, the process is complete. Remember, a file that ends with .COM can be executed from the DOS prompt. But if you save the file with any other extension, you must BLOAD and then CALL it from BASIC. Appendix C of the IBM BASIC manual contains more information about combining machine language with BASIC.

PCjr And PC-Compatibles

Because the PCjr's cartridge BASIC does not support the BASIC SHELL command, you cannot run Mini-Assembler on a PCjr with cartridge BASIC. If you have a PC-compatible MS-DOS computer, you may be able to use Mini-Assembler with little or no modification if your BASIC is compatible with IBM BASICA. DEBUG.COM is an MS-DOS (not an IBM) product, and is supplied with many MS-DOS machines. Keep in mind, however, very few so-called compatible computers are truly compatible with the PC in every way. There are many slight incompatibilities which might prevent this program from working as intended on a non-IBM machine.

Program 1: PC Mini-Assembler

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
HP 10 REM MINI ASSEMBLER
JJ 20 DIM SC$(100),NL$(100),OF$(
      100),L$(25),AD$(25),SG$(25
      )'MAKE LARGER IF NECESSARY
MM 30 KEY OFF:SCREEN 0:CLS:COLOR
       2:DEFINT A-Z:FILES
ID 40 ON ERROR GOTO 770
NN 50 X=1:L=1:FI=1:INPUT "ENTER
      SOURCE FILE";F$
IP 60 IF LEN(F$)=0 THEN PRINT "B
      ye":END
HO 70 OPEN F$ FOR INPUT AS #FI:C
      LS
DE 80 ON ERROR GOTO 0
KM 90 LINE INPUT #FI,A$:PRINT A$
      :GOSUB 730:IN$="*":GOSUB 6
      60:IF A=0 THEN IF NOT EOF(
      FI) THEN 90:ELSE PRINT"NOT
       ASCII FILE OR NO STARTING
       ADDRESS":END
GO 100 A$=STRING$(20,32)+"A "+R$
      :NL$(X)=A$:A$=R$:IN$=":":
      GOSUB 660:SG=VAL("&H"+L$)
      :OF=VAL("&H"+R$)
OI 110 WHILE NOT EOF(FI)
CM 120 LINE INPUT #FI,A$:PRINT A
      $
OM 130 GOSUB 730:IF A=0 THEN 280
EM 140 IN$="INCLUDE":GOSUB 660:I
      F A>0 THEN FI=FI+1:OPEN R
      $ FOR INPUT AS #FI:GOTO 2
      80
OH 150 IN$="EQU":GOSUB 660:IF A>
      0 THEN L=L+1:GOSUB 720:AD
      $(L)=R$:R$=L$:GOSUB 720:L
      $(L)=R$:GOTO 280
ND 160 IN$="=":GOSUB 660:IF A>0
      THEN L=L+1:GOSUB 720:T$=R
      $:R$=L$:GOSUB 720:L$(L)=R
      $:SG$(L)=T$:GOTO 280
FO 170 X=X+1
DI 180 IN$=".":GOSUB 660:IF A=0
      THEN 200:ELSE A$=R$:R$=L$
      :GOSUB 720:L=L+1:L$(L)=R$
      :SC$(X)=SC$(X)+R$+".":IF
      A$="" THEN IF NOT EOF(FI)
       THEN LINE INPUT #FI,A$:P
      RINT A$:BOSUB 730:GOTO 18
      0:ELSE A$="DB":GOTO 200
GN 190 IN$="OB":GOSUB 660:T=A:IN
      $="OW":GOSUB 660:IF T+A>0
       THEN SG$(L)="CS:"
FN 200 IN$="'":GOSUB 660:IF A>0
      THEN A$=L$+HEX$(ASC(R$))+
      RIGHT$(R$,LEN(R$)-1)
GA 210 IN$="OUP":GOSUB 660:IF A=
      0 THEN 250:ELSE R=VAL("&H
      "+R$):T$=L$+" ":A$=R$:IN$
      ="(":GOSUB 660:A$=R$:IN$=
      ")":GOSUB 660:D$=L$:FOR N
      =1 TO R
LO 220 IF LEN(T$+O$)<73 THEN T$=
      T$+O$:ELSE NL$(X)=T$:SC$(
      X)=SC$(X)+T$:X=X+1:T$=LEF
      T$(T$,2)+" "+D$
BK 230 IF N<R AND LEN(T$+O$+",")
      <74 THEN T$=T$+",
LE 240 NEXT:IF LEN(T$+R$) >=73 T
      HEN NL$(X)=T$:SC$(X)=SC$(
      X)+T$:X=X+1:A$=LEFT$(T$,2
      )+" "+RIGHT$(R$,LEN(R$)-1
      ):GOTO 210:ELSE A$=T$+R$:
      GOTO 210
```

```
ON 250 SC$(X)=SC$(X)+A$
AO 260 IN$="OFFSET":GOSUB 660:IF
       A>0 THEN A$=L$+R$
NL 270 NL$(X)=A$
BO 280 WENO:CLOSE FI:FI=FI-1:IF
       FI>0 THEN 110
EN 290 X=X+1:NL$(X)=" ":X=X+1:NL
       $(X)="0":EX=1
PN 300 WHILE EX=1:EX=0:FOR M=2 T
       O L:IF LEN(L$(M))>LEN(L$(
       M-1)) THEN SWAP L$(M),L$(
       M-1):SWAP AO$(M),AO$(M-1)
       :SWAP SG$(M),SG$(M-1):EX=
       1
KN 310 NEXT:WENO:L=L-1
JB 320 FOR M=1 TO L:A$=SG$(M):IN
       $=":":GOSUB 660:IF A>0 TH
       EN IF R$>"" THEN AO$(M)="
       [":R$+"]":SG$(M)=L$+":"
NF 330 NEXT
OP 340 CLS:OPEN "(MA).1" FOR OUT
       PUT AS #2:FOR N=1 TO X:A$
       =NL$(N):FOR M=1 TO L
KB 350 IN$=L$(M):GOSUB 660:IF A=
       0 THEN 410
BP 360 IF AO$(M) >"" THEN:A$=SG$
       (M)+L$+" "+AO$(M)+R$:NL$(
       N)=A$:GOTO 350
LK 370 IF LEFT$(A$,4)="CALL" THE
       N 400
PA 380 IF LEFT$(A$,1)="J" THEN A
       $="mov ax,bx":GOTO 410 'P
       REVENTS OUT OF RANGE ERRO
       R
AG 390 IN$="OFFSET":A$=SC$(N):T1
       $=L$:T2$=R$:GOSUB 660:IF
       A=0 THEN A$=SG$(M)+T1$+"
       [00]"+T2$:GOTO 410:ELSE L
       $=T1$:R$=T2$

NN 400 A$=L$+" 00"+R$
PE 410 NEXT M
KG 420 PRINT #2,A$:PRINT A$:NEXT
       :CLOSE
OL 430 EX=1:WHILE EX=1:EX=0:FOR
       N=1 TO L:IF AO$(N) >"" TH
       EN FOR M=N TO L:L$(M)=L$(
       M+1):AO$(M)=AO$(M+1):SG$(
       M)=SG$(M+1):NEXT:L=L-1:EX
       =1
GL 440 NEXT:WENO
NN 450 SHELL"DEBUG < (MA).1 >(MA
       ).2"
DJ 460 AGAIN=0:OPEN "(MA).2" FOR
        INPUT AS #1
BO 470 FOR N=1 TO X:LINE INPUT #
       I,A$:IF AGAIN=0 THEN IF M
       IO$(A$,6,4)<>OF$(N) THEN
       AGAIN=1
NO 480 OF$(N)=MIO$(A$,6,4)
FB 490 IN$="^":GOSUB 660:IF A>0
       THEN CLS:PRINT"ERROR!":CL
       EAR:CLOSE:SHELL"TYPE (MA)
       .2":END
CO 500 FOR M=1 TO L:T$=A$:A$=SC$
       (N):IN$=L$(M)+".":GOSUB 6
       60:IF A>0 THEN AO$(M)=OF$
       (N):A$=T$
GJ 510 NEXT:INPUT #1,JUNK$
CB 520 NEXT:CLOSE:CLS:OPEN"(MA).
       1" FOR OUTPUT AS #2
IO 530 FOR N=1 TO X:A$=NL$(N):FO
       R M=1 TO L
CC 540 IN$=L$(M):GOSUB 660:IF A=
       0 THEN GOTO 580
PC 550 IF LEFT$(A$,1)="J" OR LEF
       T$(A$,4)="CALL" THEN GOTO
        570
JK 560 IN$="OFFSET":A$=SC$(N):T1
       $=L$:T2$=R$:GOSUB 660:IF
       A=0 THEN A$=SG$(M)+T1$+"
       ["+AO$(M)+"]"+T2$:GOTO 5B
       0:ELSE L$=T1$:R$=T2$
NE 570 A$=L$+" "+AO$(M)+R$
IL 5B0 NEXT:PRINT #2,A$:PRINT OF
       $(N)" ";A$:NEXT:CLOSE
JN 590 IF AGAIN=1 THEN 450
                  'ONE MORE TIME
       !
EA 600 CLS:PRINT"LABEL" TAB(30)
       "ADDRESS":PRINT:FOR N=1 T
       O L:PRINT L$(N) TAB(30) S
       G$(N) AO$(N):NEXT
PI 610 PRINT:INPUT"ENTER OUTPUT
       FILENAME OR HIT RETURN TO
        EXIT ";A$
IN 620 IF A$=""THEN 650:ELSE IF
       A$=F$ THEN PRINT:PRINT F$
        " IS THE NAME OF YOUR SO
       URCE FILE.":PRINT:GOTO 61
       0:ELSE IN$=".":GOSUB 660
OJ 630 DEF SEG=SG:IF A>0 THEN IF
        R$="COM" OR R$="com" THE
       N OPEN A$ FOR OUTPUT AS #
       1:FOR N=OF TO VAL("&h"+OF
       $(X-1)):PRINT #1,CHR$(PEE
       K(N));:NEXT:CLOSE:GOTO 65
       0
NF 640 BSAVE A$,OF,VAL("&H"+OF$(
       X-1))-OF
IB 650 INPUT"SCRATCH WORK FILES
       Y/N";A$:IF A$="Y" OR A$="
       y" THEN CLEAR:SHELL"ERASE
        (MA).?":END:ELSE END
LO 660 A=0:B=0:C=0:F=0
NH 670 A=INSTR(F+1,A$,IN$):IF A=
       0 THEN RETURN
AB 680 B=INSTR(B+1,A$,CHR$(34)):
       IF B>0 THEN IF B<A THEN C
       =C+1:GOTO 680
MB 690 IF (C AND 1) THEN F=A:GOT
       O 670
EG 700 L$=LEFT$(A$,A-1):R$=RIGHT
       $(A$,LEN(A$)-LEN(IN$)-A+1
       ):GOSUB 710:GOSUB 720:RET
       URN
CL 710 IF RIGHT$(L$,1)=" " THEN
       L$=LEFT$(L$,LEN(L$)-1):GO
       TO 710:ELSE RETURN
PG 720 IF LEFT$(R$,1)=" " THEN R
       $=RIGHT$(R$,LEN(R$)-1):GO
       TO 720:ELSE RETURN
HI 730 IN$=STR$(VAL(A$)):IN$=RIG
       HT$(IN$,LEN(IN$)-1):GOSUB
        660:GOSUB 720:A$=R$
LN 740 IN$=";":GOSUB 660:IF A>0
       THEN A$=L$
HJ 750 IN$="%":GOSUB 660:IF A>0
       THEN V=VAL(R$):IN$="%"+RI
       GHT$(STR$(V),LEN(STR$(V))
       -1):GOSUB 660:A$=L$+" "+H
       EX$(V)+R$:GOTO 750
IG 760 A=LEN(A$):RETURN
EF 770 IF ERR=53 THEN PRINT "Fil
       e not found":RESUME 80
OO 780 ON ERROR GOTO 0
```

Typing Note: Programs 2–4 are not BASIC programs. Read the typing instructions in the article before you enter these listings.

Program 2: HEXCONV.ASM

```
BJ 100 ;HEXCONV.ASM - FROM COMPU
       TE!'s beginners guide to
       machine language
NP 110 ;MINI ASM VERSION
JG 120 * 1C00:100
                  ;OFFSET OF 100
       H - COM FILE
NO 130 ;
EO 140 CR           EQU %13
                  ;ALL NUMBERS I
       N HEX UNLESS PRECEDED
                  BY A PERCENT SIGN
NA 150 LF           EQU %10
NG 160 ;
OI 200 INCLUDE STACK.LIB
                           ;INCLU
       DES PROGRAM 3
ON 225 ;
HO 260              PUSH DS
FG 270              MOV AX,0
KO 280              PUSH AX
IE 290              MOV CX,0
HN 300 ANOTHER.
LL 310              MOV AX,CX
PN 320              CALL WORD OUT
FA 330              MOV DL,CR
CB 340              MOV AH,2
NO 350              INT 21
AC 360              MOV DL,LF
CN 370              MOV AH,2
NE 380              INT 21
FC 390              INC CX
LK 400              JNZ ANOTHER
CL 410              RETF
                  ;USE RETF FOR
       FAR RETURN
GO 420 ASCIINUMS.   DB"0123456789
       ABCDEF"     ;USE QUOTES RA
       THER THAN APOSTROPHE
NI 430 WORD OUT.
NJ 440              PUSH CX
LF 450              PUSH BX
OO 460              PUSH DX
IC 470              MOV CH,4
NA 480 LOOP1.       MOV CL,4
CH 490              ROL AX,CL
JG 500              PUSH AX
CB 510              AND AL,F
BP 520              MOV BX,OFFSET
        ASCIINUMS ;"CS:" PREFIX
       AUTOMATICALLY PUT IN
FC 530              XLAT ;ASCIINU
       MS           LEAVE OFF ASCI
       INUMS - IT's implied
JO 540              MOV DL,AL
CF 550              MOV AH,2
NC 560              INT 21
KG 570              POP AX
OL 580              DEC CH
ND 590              JNZ LOOP1
OI 600              POP DX
LA 610              POP BX
NN 620              POP CX
NK 630              RET
                  ;NEAR RETURN
```

Program 3: STACK.LIB

```
NN 10 ;STACK.LIB
HE 20       MOV SP,OFFSET TOP OF S
       TACK-1
KN 30       MOV AX,CS
HB 40       MOV SS,AX
NG 50       JMP START OF PROGRAM
DJ 60       DB OUP %128 (0);256 BY
       TES FOR STACK
PN 70       TOP OF STACK.
GI B0       START OF PROGRAM.
```

Program 4: CLS.LIB

```
LA 100 ;* * * CLEAR SCREEN ROUTI
       NE
GP 110 CLS.
          ;CALL ROUTINE USING CL
       S AS DEFINED HERE.
FJ 120 MOV CX,0
EB 130 MOV DL,%79
JE 140 MOV DH,%24
NF 150 MOV AL,0
QM 160 MOV BH,7
PJ 170 MOV AH,6
NH 180 INT 10
ON 190 RET
```

Mozart Magic

James Bagley

Based on a musical game devised by the composer Mozart, this delightful program for the Commodore 128 composes its own minuets in the style of Mozart himself.

This Commodore 128 program is a translation of a game by Wolfgang Amadeus Mozart. It composes a complete, original minuet at random. Mozart delighted in games of chance, so it was only natural that he should combine his two interests and produce an activity known as *Musikalisches Wuerfelspiel*, or musical craps. The idea was not original with Mozart, but his effort was the most successful.

Making Music

Type in and save the program; then run it. After it plays an introduction and initializes, the program displays a menu. You can choose a different instrument for each voice, but most songs sound best if you choose the same instrument for all three voices. Some of the instruments such as the drum and xylophone may sound strange or faint; they are included for the sake of completeness, so you can hear what all the 128's instruments sound like.

The next menu allows you to change the tempo. Press F to increase the speed at which the minuet is played, press S to decrease the speed, and press E to exit the routine. The tempo always defaults to 8. The main menu reappears after the minuet is finished.

The program itself is structured to reflect the composer's original technique. Mozart set up two grids of 8 columns and 11 rows. The columns were numbered 1–8, and the rows were numbered 2–12. On the first throw of the dice, he scanned down the first column to the row numbered the same as the sum of the two die. At this intersection was a number. He then copied down a measure of music corresponding to this number and repeated the process until he reached the eighth column of the first part.

In the eighth column of the grid, each number referred to a measure of music with two sets of notes. Because the music modulated to the dominant, the lower notes served for the first ending and the upper notes were for the second ending. Since these measures were all the same, M2$(1) is used in the program for the first ending and M2$(2) for the second ending of the first part of the minuet.

Mozart Magic

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!

```
RM 10 SCNCLR:PRINT"{9 DOWN}
      {RVS}{14 RIGHT}MOZART MA
      GIC"
GH 20 TEMPO8:PLAY"O4QCICCCC.CS
      FQCRO3$BI$B$B$B$BSO4CO3$
      BA$BIARBQBIBBBBO4.CSDQES
      RE.FSDQCO3BO4C"
DB 30 DIMM$(7,11),M1$(8,11),M2
      $(2),R(7),R1(B)
RK 40 FORI=1TO7:FORJ=1TO11:REA
      DM$(I,J):NEXT:NEXT
EH 50 FORI=1TO8:FORJ=1TO11:REA
      DM1$(I,J):NEXT:NEXT
FR 60 M2$(1)="V2O4QDV3GV1O1IGO
      2SGFEDM":M2$(2)="V2O4QDV
      3GV1O1IGO2SBG#FEM"
GG 70 SCNCLR:FORV=1TO3
CB 80 PRINT"{HOME}{DOWN} CHOOS
      E AN INSTRUMENT FOR VOIC
      E"V
PJ 90 PRINT"{DOWN} {RVS}0{OFF}
      PIANO
ME 100 PRINT"{DOWN} {RVS}1
      {OFF} ACCORDION
EF 110 PRINT"{DOWN} {RVS}2
      {OFF} CALLIOPE
KS 120 PRINT"{DOWN} {RVS}3
      {OFF} DRUM
DM 130 PRINT"{DOWN} {RVS}4
      {OFF} FLUTE
FR 140 PRINT"{DOWN} {RVS}5
      {OFF} GUITAR
EB 150 PRINT"{DOWN} {RVS}6
      {OFF} HARPSICHORD
DB 160 PRINT"{DOWN} {RVS}7
      {OFF} ORGAN
CD 170 PRINT"{DOWN} {RVS}8
      {OFF} TRUMPET
FE 1B0 PRINT"{DOWN} {RVS}9
      {OFF} XYLOPHONE
RD 190 GETKEYI$:IFI$<"0"ORI$>"
      9"THEN190
BE 200 INS=VAL(I$)
KM 210 IFV=1THENPLAY"V1
CX 220 IFV=2THENPLAY"V2
PR 230 IFV=3THENPLAY"V3
FS 240 IFINS=0THENPLAY"T0
KD 250 IFINS=1THENPLAY"T1
SA 260 IFINS=2THENPLAY"T2
DG 270 IFINS=3THENPLAY"T3
JP 280 IFINS=4THENPLAY"T4
RJ 290 IFINS=5THENPLAY"T5
FX 300 IFINS=6THENPLAY"T6
MQ 310 IFINS=7THENPLAY"T7
AG 320 IFINS=BTHENPLAY"TB
PA 330 IFINS=9THENPLAY"T9
EJ 340 NEXT:SCNCLR
RQ 350 N=8:DO
AR 360 PRINT"{HOME}{DOWN} TEMP
      O{4 RIGHT}{3 SPACES}
      {4 LEFT}"N
DC 370 PRINT"{DOWN} {RVS}F
      {OFF}ASTER
FF 380 PRINT"{DOWN} {RVS}S
      {OFF}LOWER
AQ 390 PRINT"{DOWN} {RVS}E
      {OFF}XIT
```

```
JF 400 GETKEYT$
XS 410 IFT$="F"THENN=N+1:IFN=>
       255THENN=255
JQ 420 IFT$="S"THENN=N-1:IFN=<
       0THENN=1
DD 430 IFT$="E"THENEXIT
FF 440 LOOP:TEMPON
MF 450 FORI=1TO7:R(I)=INT(RND(
       1)*11+1):NEXT
JR 460 FORI=1TO8:R1(I)=INT(RND
       (1)*11+1):NEXT:SCNCLR
MP 470 FORK=1TO2:FORI=1TO7:PLA
       YM$(I,R(I)):NEXT:PLAYM2
       $(K):NEXT
KF 480 FORK=1TO2:FORI=1TO8:PLA
       YM1$(I,R1(I)):NEXT:NEXT
RF 490 GOTO70
AP 500 REM FIRST THROW
EX 510 DATA V1O2QCV3O4IECO3GM,
       V1O2QCV2EV3O3IGO4CEM,V1
       O2QCV2EV3O4IGECM,V1O2QC
       V2EV3O4SCO3BO4CEO3GO4CM
       ,V1O2QCV2EV3O5SCO4BO5CO
       4GECM,V1O2QCV3O4SEDEGO5
       CO4GM
BC 520 DATA V1O2QCV2EV3O4IGSFE
       DCM,V1O2QCV2EV3O4SECGEO
       5CO4GM,V3O4ICV1O2SCV2EG
       MV3O3IGV1Q2SCV2EGMV3Q4I
       EV1O2SCV2EGM
XS 530 DATA V1Q2QCV2EV3O4IGCEM
       ,V1O2ICV2O3EV3O4CV1O2CV
       2O3EV3O4CV1O2CV2O3EV3O4
       CM
GX 540 REM SECOND THROW
MM 550 DATA V1O2QCV3O4IECO3GM,
       V1O2QCV2EV3O3IGO4CEM,V1
       O2QCV2EV3O4IGECM,V1O2QE
       V2GV3O4SCO3GO4CEO3GO4CM
XP 560 DATA V1O2QCV2EV3O5SCO4B
       O5CO4GECM,V1O2QCV3O4SED
       EGO5CO4GM,V1Q2QCV2EV3O4
       IGSFEDCM,V1Q2QCV2EV3O4S
       CO3GO4ECGEM
SK 570 DATA V1O2QCV2EV3O4ICO3G
       O4EM,V1O2QCV2EV3O4IGCMV
       1O2CV2GV3O4EM,V1O2ICV2O
       3EV3O4CV1Q2CV2O3EV3O4CV
       1O2CV2O3EV3Q4CM
BG 5B0 REM THIRD THROW
RH 590 DATA V1O1QBV2O2GV3O4SDE
       FDMV1O1IGV3O4CO3BM,V1O1
       QGV3O3IBO4DGM,V1O1QGV3O
       3IBO4SDO3BAGM,V1O2QGV2B
       V3O4IFDO3BM
SJ 600 DATA V1O1QBV2O2DV3O4SG#
       FGDO3BGM,V1O2QGV2BV3O4S
       FEFDCO3BM,V1O1QGV2O2GV3
       O3SBO4CDEMV1O1IBV2O2GV3
       O4SFDM
CC 610 DATA V1O2IGV2O3BV3O4DV1
       O2GV2O3BV3O4DV1O2GV2O3B
       V3O4DM,V1O1QGV3O3SBO4CD
       O3BAGM,V1O1QBV3O4IDO3BG
       M,V1O2QGV3O3SBABO4CDO3B
       M
QH 620 REM FOURTH THROW
JS 630 DATA V1O2QCV2EV3O4SCO3B
       O4CEO3IGM,V1O2QCV3O4SEC
       O3BO4CO3IGM,V1O2QEV2GV3
       O4ICO3GEM,V1O2QEV2GV3O4
       ICEO3GM
PC 640 DATA V1O2QEV2GV3O4SCO3B
       O4CO3GECM,V1O2QCV2EV3O4
       ICSCDIEM,V1O2QCV2O4ICV3
       EV2SCV3EV2DV3FV2IEV3GM
XP 650 DATA V1O2QEV2GV3O4ICSEC
       O3IGM,V1O2QEV2GV3O4SCO3
       GO4ECIGM,V1O2QEV2GV3O4I
       CSECIGM,V1O2QEV2GV3O4SC
       ECO3GIEM
KE 660 REM FIFTH THROW
HS 670 DATA V1O2QCV3O4I#FSA#FD
       #FM,V1O2ICV2O3#FV3O4DV1
       O2CV2O4DV3#FV1O2CV2O4#F
       V3AM,V1O2QCV3O4SDO3AO4#
       FDA#FM
HB 680 DATA V1O2ICV2O3#FV3O4DV
       1O2CV2O3#FV3O4DV1O2CV2O
       3#FV3O4DM,V1O2QCV3O4IDO
       3SABAO4I#FM,V1O2QCV3O4S
       D#CD#FA#FM
HM 690 DATA V1O2QCV2AV3O4I#FAM
       V1O2CV2AV3O4DM,V1O2ICV2
       #FV3O3AV1O2CV2#FV3O3SAO
       4DMV1O2ICV2AV3O4#FM
QX 700 DATA V1O2ICV2O4DV3#FV1O
       2CV2O4DV3#FV1O2CV2O4DV3
       #FM,V1O2ICV2DV3O4#FV1O2
       CV2DV3O4S#FDMV1O2ICV2DV
       3O4AM,V1O2QCV2AV3O4S#FD
       O3AO4A#FDM
EM 710 REM SIXTH THROW
QH 720 DATA V1O2IBV2O2DV3O4SG#
       FMV1O1IBV2O2DV3O4SGBMV1
       O1IBV2O2DV3O4DM,V1O1QBV
       2O2DV3O4IGSBGDO3BM,V1O1
       QBV2O2DV3O4IGBDM
FR 730 DATA V1O1QBV2O2GV3O3IAS
       #FGBO4GM,V1O1QBV2O2DV3O
       4SG#FGDMV1O1IBV2O2GV3O3
       SBGM,V1O1QBV3O4IGSBGDGM
       ,V1O1QBV2O2GV3O4IDSGDO3
       BO4DM,V1O1QBV2O2GV3O4ID
       SDGIBM
AA 740 DATA V1O1IBV2O2DV3O4SAG
       MV1O1IBV2O2DV3O4S#FGMV1
       O1IBV2O2GV3O4DM,V1O1QBV
       2O2DV3O4IGSGDIBM,V1O1QB
       V2O2DV3O4SGBGDO3IBM
EQ 750 REM SEVENTH THROW
XQ 760 DATA V1O2ICV3O4SECMV1O2
       IDV3O3SBAMV1O1IDV3O3SG#
       FM,V1O2ICV3O3SAO4EMV1O2
       IDV2O3SBV3O4DV2O3AV3O4C
       MV1O1IDV2O3SGV3BV2#FV3A
       M
BR 770 DATA V1O2ICV2O3SBV3O4DV
       2O3AV3O4CMV1O2IDV2O3AV3
       O4CV2O3GV3BMV1O1IDV2O3S
       GV3BV2#FV3AM,V1O2ICV3O4
       SEGMV1O2IDV3O4SDCMV1O1I
       DV3O3SBAM
AJ 780 DATA V1O2ICV3O3SAO4EMV1
       O2IDV3O4SDGMV1O1IDV3O4S
       #FAM,V1O2ICV3O4SEAMV1O2
       IDV3O4SGBMV1O1IDV3O4S#F
       AM,V1O2ICV3O4SCEMV1O2ID
       V3O4SGDMV1O1IDV3O3SAO4#
       FM
RP 790 DATA V1O2ICV3O4SEGMV1O2
       IDV3O4SDGMV1O1IDV3O3SBO
       4#FM,V1O2ICV3O4SECMV1O2
       IDV3O3SBGMV1O1IDV3O3SA#
       FM,V1O2ICV3O4SEO5CMV1O2
       IDV3O4SBGMV1Q1IDV3O4SA#
       FM
DQ B0Ø DATA V1O2ICV3O3AV1O2DV3
       O4SDCMV1Q1IDV3O3SBAM
HX 810 REM PART TWO FIRST THRO
       W
XG 820 DATA V1O2QDV3O4I#FSA#FM
       V1O2ICV3O4SD#FM,V1O2QDV
       2#FV3O4SDO3AO4D#FA#FM,V
       1O2IDV2AV3O4#FV1O2DV2#F
       V3O4AV1O2CV2DV3O4#FM
DG 830 DATA V1O2QCV2AV3O4S#FAO
       5DO4AMV1O2ICV2AV3O4#FAM
       ,V1O2QDV3O3SD#FAO4DMV1O
       2ICV3O4S#FAM
PP 840 DATA V2O4IDV3#FV1O1SDO2
       DMV3O4Q#FV1Q2S#CDCDM,V1
       Q2QDV2#FV3O4IA#FMV1O2CV
       2#FV3DM,V1O2QDV2#FV3O5I
       DO4SA#FMV1Q2ICV2#FV3O4S
       DO3AM
GC 850 DATA V1O2QDV2#FV3O4SDQ3
       AO4ID#FM,V1O2QCV2AV3O4S
       #FDO3IAMV1O2CV2AV3O4#FM
       ,V1O2QDV2#FV3O3IAO4DMV1
       O2CV2AV3O4#FM
PD 860 REM PART TWO SECOND THR
       OW
AG B70 DATA V1O1QBV2O2GV3O4IGS
       BGIDM,V3O4IGV1O1SBO2DMV
       3O3IGV1O2SGDMV3O3IGV1O1
       SBGM,V1O1QBV3O4SGBGBIDM
CC BB0 DATA V1O1QBV2O2DV3O4SAG
       BGMV1O1IBV2O2DV3O4SDGM,
       V1O1QBV2O2DV3O4IGSDO3BM
       V1O1IBV2O2DV3O3GM
JK B90 DATA V1O1QBV2O2DV3O4SGB
       O5DO4BMV1O1IBV2O2DV3O4G
       M,V1O1QBV2O2DV3O4SGBGDO
       3BGM,V1O1QBV2O2DV3O4SGD
       GBMV1O1IBV2O2DV3O4SGDM
DP 900 DATA V1O1QBV2O2DV3O4SGB
       IGMV1O1IBV2O2GV3O4DM,V3
       O4IGV1O1SGBMV3O4QDV1O2I
       GO1BM,V1O1QBV3O4IGSBO5D
       O4IDM
AF 910 REM PART TWO THIRD THRO
       W
XJ 920 DATA V2O4ICV3EV1O2SCEMV
       2O4ICV3EV1O2SGEMV2O4ICV
       3EV1O3SCO2CM,V1O2QEV3O4
       SCO3GO4CEMV1O2EV3O4GV1O
       2CV2O4CV3EM,V1O2QCV2GV3
       O4IESGEMV1O2ICV2DV3O4CM
XE 930 DATA V1O2QCV2GV3O4SECEG
       O5CO4GM,V1O2QCV2GV3O4SE
       GO5CO4GMV1O2ICV2GV3O4SE
       CM,V2O4ICV3EV1O2SCO1BMV
       3O4QEV1O2SCDE#FM
PM 940 DATA V3O4IEV1O2SCV2EGMV
       3O4ICV1O2SCV2EGMV3O3IBV
       1O2SCV2EGM,V1O2QCV2GV3O
       4IESCEMV1O2CV2EV3O4GO5C
       M
RF 950 DATA V1O2QCV2GV3O4SECIE
       MV1O2CV2EV3O4GM,V1O2QCV
       2GV3O4SECO3IGMV1O2CV2GV
       3O4EM,V1O2QCV2GV3O4IEGM
       V1O2CV2EV3O5CM
FR 960 REM PART TWO FOURTH THR
       OW
EP 970 DATA V1O2QGV2O4ICV3EV2O
       3BV3O4DMV1O1GM,V1O1QGV2
       O2GV3O4SDO3BIGMV1O2GM,V
       1O2IGV2O4CV3EMV1O1GV2O3
       SBV3O4DV2O3GV3BV2IGM
JE 980 DATA V1O2QGV3O4SECDO3BI
       GM,V1O2IGV3O4SGEMV1O1IG
       V3O4SDO3BIGM,V1O2QGV3O3
       SBO4DGDMV1O1IGV3O3BM,V1
       O2IGV3O4SECMV1O1IGV3O3S
       BO4DIGM
RF 990 DATA V1O2QGV2BV3O4SDBGD
       O3IBM,V1O1QBV2O2GV3O4SD
       O3BIGMV1O1BV2O2DV3O4GM,
       V3O4IDV1O2SG#FMV3O3QBV1
       O2SGDO1BGM
GA 1000 DATA V1O2QGV2O3IBV3O4D
       SGBMV1O2IGV3O4DM
MK 1010 REM PART TWO FIFTH THR
       OW
MJ 1020 DATA V3O4IEV1O2SCV2EGM
       V3O4ICV1O2SCV2EGMV3O3I
       GV1O2SCV2EGM,V3O3IGV1O
       2SCV2EGMV3O4ICV1O2SCV2
       EGMV3O4IEV1O2SCV2EGM
AK 1030 DATA V3O4IGV1O2SCV2EGM
```

```
          V304EV102SCV2EGMV304IC
          V102SCV2EGM,V102QCV2EV
          304SC03B04C04EMV102IEV
          2GV303SG04CM
PX 1040   DATA V102QCV2EV305SC04
          B05C04GMV102ICV2GV304S
          ECM,V102QCV2GV304SEDEG
          MV102ICV2EV305SC04GM,V
          102QCV2EV304IGSFEDCM
SQ 1050   DATA V102QCV2EV304SC03
          G04ECGEM,V304ICV102SCV
          2EGMV303IGV102SCV2EGMV
          304IEV102SCV2EGM
XQ 1060   DATA V304IGV102SCV2EGM
          V304ICV102SCV2EGMV304I
          EV102SCV2EGM,V102ICV20
          3EV304CV102CV303EV304C
          V102CV203EV304CM
GG 1070   REM PART TWO SIXTH THR
          OW
RX 1080   DATA V304IEV102SCV2EGM
          V304ICV102SCV2EGMV303I
          GV102SCV2EGM,V102QCV2E
          V303IB04CMV102CV2GV304
          EM,V304IGV1Q2SCV2EGMV3
          04IEV102SCV2EGMV304ICV
          102SCV2EGM
BQ 1090   DATA V102QCV2EV304SC03
          B04EMV102ICV2EV303SG04
          CM,V102QCV2EV305SC04BO
          5CQ4GECM,V102QCV2GV304
          SEDECMV102ICV2EV305SCO
          4GM
QH 1100   DATA V102QCV2EV304IGSF
          EMV102IEV2GV304SDCM,V1
          02QCV2EV304SC03G04ECGE
          M,V304ICV102SCV2EGMV30
          3IGV102SCV2EGMV304IEV1
          Q2SCV2EGM
RX 1110   DATA V304IGV102SCV2EGM
          V304ICV102SCV2EGMV304I
          EV102SCV2EGM,V102ICV20
          3EV304CV102CV203EV304C
          V1Q2CV2Q3EV304CM
BM 1120   REM PART TWO SEVENTH T
          HROW
XK 1130   DATA V102QFV2AV304SDFD
          FMV102IGV203DV3SB04DM,
          V102QFV304SDFAFMV102IG
          V304SD03BM,V102QDV304S
          DFO3AO4DMV102IGV303SBO
          4DM
BB 1140   DATA V102QFV304SD#CDFM
          V102IGV303SGBM,V102IFV
          304FV102DV304DV102GV3O
          4GM,V102SFV304FV102EV3
          04EV102DV304DV102EV304
          EV102FV304FV102GV302GM
BQ 1150   DATA V102SFV304FV102EV
          304EV102IDV304DV102GV3
          04GM,V102QFV304SFEDCMV
          102IGV303SB04DM,V102QF
          V304SFD03IAMV102GV303B
          M
PF 1160   DATA V102QFV304SFAO3IA
          MV102GV303SB04DM,V102Q
          FV303IAO4SFDMV102IGV30
          3SABM
XB 1170   REM SECOND PART EIGHTH
           THROW
CG 11B0   DATA V304QCV102IC01GCM
          ,V304QCV102IC01GCM,V30
          4QCV102IC01GCM,V304QCV
          102IC01GCM,V304QCV102I
          C01GCM,V304QCV102IC01G
          CM
CG 1190   DATA V304QCV102IC01GCM
          ,V304QCV102IC01GCM,V30
          4QCV102IC01GCM,V102QCV
          304IC03CV101CM,V304QCV
          102IC01GCM
```

©

ST Reversi

Kevin Mykytyn, Editorial Programmer

This adaptation of a classic strategy game can be played on any Atari ST system with a color monitor. You can play against a friend or the computer.

"ST Reversi" is a fresh translation of a venerable game known by several different names. Ever since ancient times, strategists have delighted in this game's simple, yet challenging premise. This version is written in ST BASIC and makes good use of the computer's graphics capabilities.

Object Of The Game

Type in the program and save a copy before you run it. You can play Reversi in either low or medium resolution. (The display looks best in low resolution.) The playing field consists of a grid of 64 squares (8 × 8). One player's pieces are black, and the other's are white. If you play against the computer, you have the white pieces.

Every game begins with four pieces—two black and two white—placed symmetrically in the middle of the board (see Figure 1). The players alternate turns by placing

Figure 1: Beginning Screen

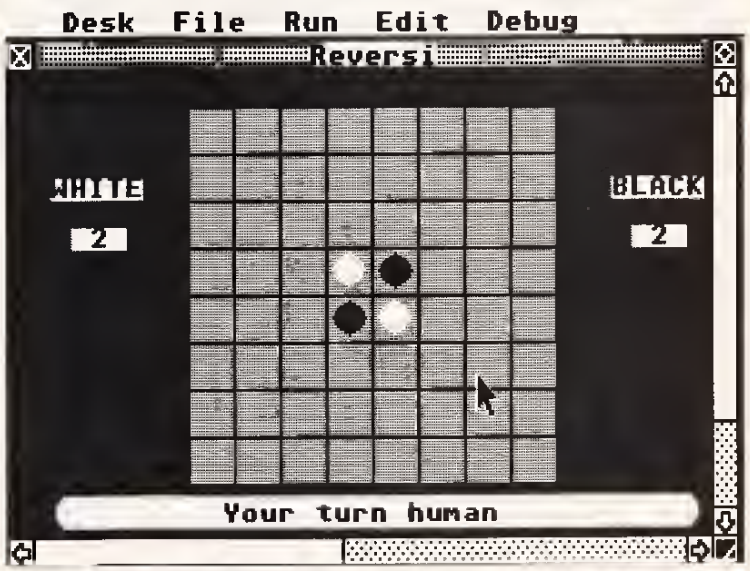


Figure 2: Before White's Move

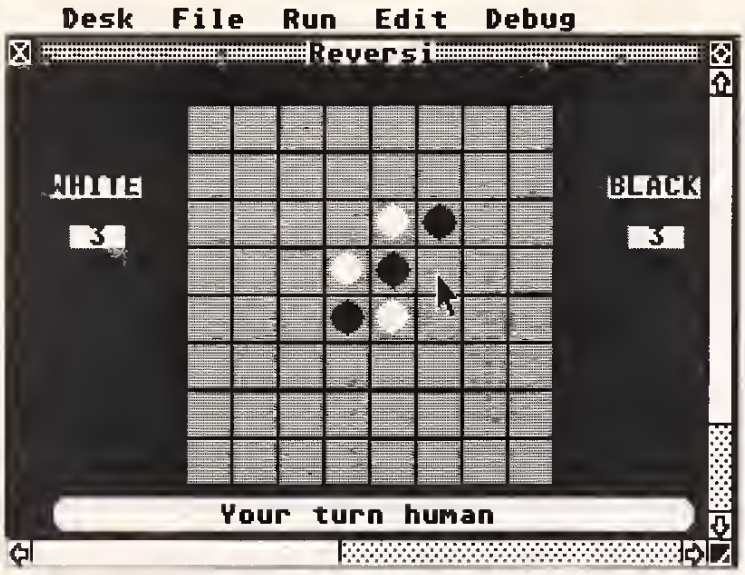
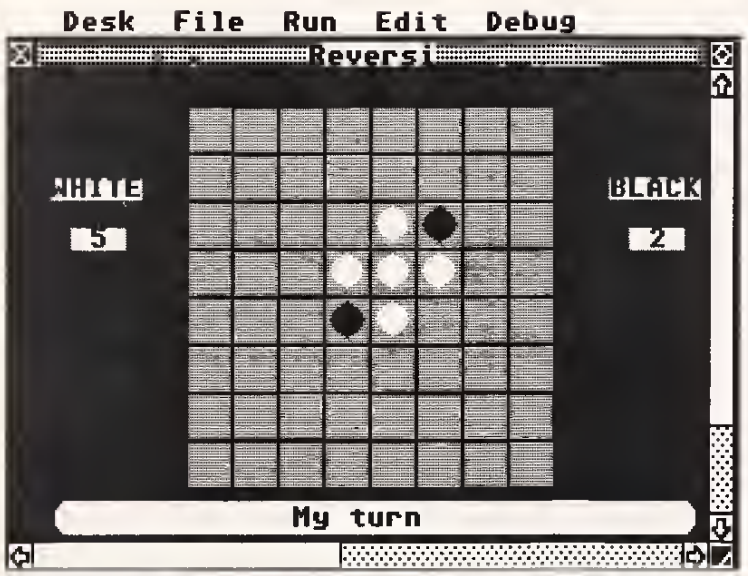


Figure 3: After White's Move



pieces on the board, and play proceeds until every square is filled or neither player can make a move. In cases where it's impossible to move, you must pass your turn.

The object of the game is to have more pieces on the board than your opponent does at the end of the game. To place a piece on the board, move the mouse pointer to the desired square and click the left button once. If the move is legal, a piece of your color appears in the designated square (the computer beeps if you attempt to make an illegal move).

To take a turn, you must place one of your pieces so that one or more of the opponent's pieces will lie in a straight line between two of yours. When you enclose an opponent's pieces in this way, the enclosed pieces will change from the opponent's color to yours. Your score is equal to the number of pieces you have on the board. The program displays both players' scores at all times and prompts you when it's time to make a move.

Figures 2 and 3 illustrate the effect of placing a piece on the board. In Figure 2, the human player (white) is about to place a piece in the square indicated by the mouse pointer. Figure 3 shows the appearance of the board after that move is made.

Dramatic Reversals

If you're playing against the computer, you may choose two different skill levels. Level 1 is the easier of the two, and it also plays faster. The higher level offers a greater challenge, but requires more time for the computer to calculate each move. Each of the computer's moves takes about 5–10 seconds at level 1 and about 20–50 seconds at level 2. Don't move the pointer while the computer is thinking; ST BASIC slows down when the pointer is in motion.

If you analyze the computer's strategy, you'll discover that it often tries to take the corner squares. The corners are the most valuable positions on the board because they can't be changed to the opposite color. Squares on the edge of the board are also strategically valuable, since they are vulnerable in only one direction.

Of course, there's no single strategy that works every time, particularly if you're playing a human opponent. Beginners often attempt to take the lead early and maintain it throughout the game, but that's not necessarily a winning strategy. When players are evenly matched, it's common for the score to seesaw back and forth several times. Dramatic reversals often occur near the end of the game—hence the name, Reversi. Experienced players try to think ahead and develop a strong strategic position with the final moves in mind.

Reversi

```
10    dim board(9,9),tboard(8,8
      ),dx(7),dy(7),path(7,1),m
      ess$(2,1),sc1(9,9)
20    restore 40:for a=0 to 9:f
      or b=0 to 9:board(a,b)=4:
      next b,a
30    for a=0 to 7:read dx(a),d
      y(a):next
40    data 0,-1,1,-1,1,0,1,1,0,
      1,-1,1,-1,0,-1,-1
50    for a=1 to 2:for b=0 to 1
      :read mess$(a,b):next b,a

60    data "        Your turn hu
      man          ","
       My turn             "
70    data "          White's tu
      rn           ","         B
      lack's turn          "
80    for a=1 to 4:for b=1 to 8
      :read c:sc1(a,b)=c:sc1(9-
```

```
      a,b)=c
90    next b,a
100   data 16,-4,4,2,2,4,-4,16,
      -4,-12,-2,-2,-2,-2,-12,-4
110   data 4,-2,4,2,1,4,-2,4,2,
      -2,2,0,0,2,-2,2
120   gosub SETSCREEN:p=0:gosub
       OPTIONS:nt=0
130   START: gosub SCORE
140   if np=2 or p=0 then 160
150   gosub TURN:gosub BESTMOVE
      :if js=-50 then 200 else
      gosub CHECKLEGAL:goto 190
160   gosub ANYMOVE:if flag=0 t
      hen 200 else gosub TURN
170   gosub READMOUSE:gosub CHE
      CKLEGAL
180   if flag=0 then gosub BEEP
      :goto 170
190   nd=0:gosub FLIPPIECES:nt=
      0
200   nt=nt+1:if nt=3 then goto
       GAMEOVER
210   p=1-p:goto START
220   SCORE: p1=0:p2=0:for a=1
      to 8:for b=1 to 8
230   if board(a,b)=0 then p1=p
      1+1
240   if board(a,b)=1 then p2=p
      2+1
250   next b:next a:color 1,1,1
      :pt=p1+p2
260   gotoxy 2,4:print "WHITE":
      gotoxy 29,4:print "BLACK"
270   gotoxy 3,6:print p1:gotox
      y 30,6:print p2
280   return
290   GAMEOVER: gosub SCORE:got
      oxy 0,0:print:gotoxy 4,17
300   if p1=p2 then print "It's
       a tie!";:goto 330
310   if p1>p2 then print "Whit
      e wins!";:goto 330
320   if p2>p1 then print "Blac
      k wins!";
330   print " - Click mouse but
      ton";:gosub GETMOUSE
340   goto 20
350   TURN: color 1,1,1:gotoxy
      0,0:print:gotoxy 4,17:pri
      nt mess$(np,p);:return
360   ANYMOVE: for tx=1 to 8:fo
      r ty=1 to 8
370   gosub CHECKLEGAL
380   if flag=1 then tx=9:ty=9
390   next ty,tx
400   return
410   CHECKMOVE: bs=-20:for tx=
      1 to 8:for ty=1 to 8
420   gosub CHECKLEGAL:ns=sc1(t
      x,ty)
430   if flag=0 then goto 450
440   if ns>bs or ns=bs and rnd
      (1)>.5 then bs=ns
450   next ty,tx
460   return
470   BESTMOVE:js=-50:nd=1:for
      tx=1 to 8:for ty=1 to 8
480   gosub CHECKLEGAL:if flag=
      0 then 560
490   for q=1 to 8:for r=1 to 8
      :tboard(q,r)=board(q,r):n
      ext q,r
500   gosub FLIPPIECES:fs=sc1(t
      x,ty):if pt>58 then fs=fs
      +f1*5
510   ptx=tx:pty=ty:if lev=2 th
      en p=0:gosub CHECKMOVE:p=
      1
520   tx=ptx:ty=pty:for q=1 to
      8:for r=1 to 8:board(q,r)
      =tboard(q,r):next r,q
530   if lev=1 then bs=0:goto 5
      50
540   if pt>58 then bs=bs+f1*5
550   if fs-bs>js or (fs-bs>js
      and rnd(1)>.5) then js=fs
      -bs:gx=tx:gy=ty
560   next ty,tx:tx=gx:ty=gy
570   if (tx=1 or tx=8) and (ty
      =1 or ty=8) then for a=0
      to 6 step 2:sc1(tx+dx(a),
      ty+dy(a))=8:next a
580   return
590   BEEP: sound 1,15,1,2,10:s
      ound 1,0,0,0,0:return
600   BONG: sound 1,15,8,3:wave
       1,1,0,10000,10:return
610   GETMOUSE: poke contr1,124
620   poke contr1+2,0:poke cont
      r1+6,0
630   vdisys(0)
640   mx=peek(ptsout):my=peek(p
      tsout+2)
650   if peek(intout)=0 then GE
      TMOUSE
660   vdisys(0):if peek(intout)
      <>0 then 660
670   return
680   READMOUSE:  gosub GETMOUS
      E
690   if mx<80 or mx>235 or my<
      35 or my>169 then READMOU
      SE
700   tx=int((mx-80)/20)+1:ty=i
      nt((my-35)/17)+1
710   if board(tx,ty)<>4 then g
      osub BEEP:goto READMOUSE
720   return
730   FLIPPIECES: f1=0:x=tx:y=t
      y:gosub PUTPIECE
740   for a=0 to 7
750   if path(a,0)=0 then 800
760   x=tx+dx(a):y=ty+dy(a)
770   for b=1 to path(a,1)
780   gosub PUTPIECE:x=x+dx(a):
      y=y+dy(a)
790   next b
800   next a:return
810   CHECKLEGAL: q=1-p:flag=0:
      if board(tx,ty)<>4 then r
      eturn
820   for a=0 to 7:path(a,0)=0
830   if board(tx+dx(a),ty+dy(a
      ))<>q then 890
840   sx=tx+dx(a):sy=ty+dy(a):c
      ounter=0
850   checkpath: counter=counte
      r+1:sx=sx+dx(a):sy=sy+dy(
      a)
860   if board(sx,sy)=4 then 89
      0
870   if board(sx,sy)=p then fl
      ag=1:path(a,0)=1:path(a,1
      )=counter:goto 890
880   goto checkpath
890   next a:return
900   PUTPIECE: f1=f1+1:board(x
      ,y)=p:if nd=1 then return
910   PUTPIECE2: px=x*20+67:py=
      y*17+3
920   color p,p,p:pcircle px,py
      ,7:gosub BONG
930   return
940   SETSCREEN: openw 2:fullw
      2:clearw 2:title$="Revers
      i":gosub SETTITLE
950   x1=20:y1=174:x2=300:y2=18
      7:p1=8:gosub BOX
960   color 3,3,3:fill 100,100:
      color 1,1,1
970   for a=77 to 237 step 20:l
      inef a,12,a,148:next
980   for a=12 to 148 step 17:l
      inef 77,a,237,a:next
990   color 2,2,2:fill 20,20
1000  nd=0:for x=4 to 5:y=x:p=0
      :gosub PUTPIECE:next
1010  p=1:x=4:y=5:gosub PUTPIEC
      E:x=5:y=4:gosub PUTPIECE
1020  return
1030  SETTITLE: a# = gb : ginti
      n = peek(a#+8)
1040  poke gintin+0,peek(systab
      +8) : poke gintin+2,2
1050  s# = gintin+4 : title$ =
      title$ + chr$(0)
1060  poke s#,varptr(title$) :
      gemsys(105)
1070  return
1080  OPTIONS: a$="Number of pl
      ayers          1  2":gosub
       MENU:np=ans
1090  if np=2 then return
1100  a$="Choose level (1 is ea
      sy)  1  2":gosub MENU:lev
      =ans
1110  a$="Do you want to go fir
      st   Y  N":gosub MENU:p=a
      ns-1
1120  return
1130  MENU: gotoxy 0,0:print:go
      toxy 4,17:print a$;
1140  gosub GETMOUSE:if my<175
      or my>187 then 1140
1150  if mx>242 and mx<255 then
       ans=1:return
1160  if mx>264 and mx<280 then
       ans=2:return
1170  goto 1140
1180  BOX: poke contrl,11:poke
      contrl+2,2:poke contrl+6,
      0:poke contrl+10,p1
1190  poke ptsin,x1:poke ptsin+
      2,y1
1200  poke ptsin+4,x2:poke ptsi
      n+6,y2
1210  vdisys(0):return
```


Attention Programmers

COMPUTE! magazine is currently looking for quality articles on Commodore, Atari, Apple, and IBM computers (including the Commodore Amiga and Atari ST). If you have an interesting home application, educational program, programming utility, or game, submit it to COMPUTE!, P.O. Box 5406, Greensboro, NC 27403. Or write for a copy of our "Writer's Guidelines."

Commodore 128 Machine Language

Part 3

Jim Butterfield, Associate Editor

This article, the third in Jim Butterfield's series on Commodore 128 machine language programming, explains how to call and link a machine language program from BASIC.

The usual way to activate a machine language (ML) program from BASIC is with a SYS command. Typically, you load and run a BASIC program, and the program loads the machine language program as needed. Sometimes the BASIC program and its accompanying ML code are combined in a single file. When you load such a program, the ML comes into memory along with the BASIC program text, so all you need is the SYS. In other cases, the BASIC program loads the ML file in a separate operation, a process known as *overlaying*.

Overlaying is a flexible technique. A BASIC program can load more than one machine language program; it can also load data, graphics screens, or other material. When programming an overlay, you must take care that a program doesn't self-destruct by loading something into memory which the program itself occupies.

Where memory is limited, overlays can greatly expand the capabilities of a computer. The program can load a machine language program into memory and use it; then the program can load a different program to the same part of memory, and so on. In theory, there's no limit to how big a program might be when it's brought into memory as a series of overlays. The CP/M system, which can also be used by the 128, works largely by means of overlays (in fact, when it boots in CP/M mode, the computer loads the entire CP/M operating system from disk).

Overlay Example

Let's write a simple machine language program and load it into memory. The program will, on request, print a given character a certain number of times, followed by a carriage return. We'll use it to draw a simple bar graph. Type MONITOR and press RETURN; then enter the following lines:

```
A 1400   JSR  $FFD2
A 1403   DEX
A 1404   BNE  $1400
A 1406   LDA  #$0D
A 1408   JMP  $FFD2
```

As you enter each line, the computer rewrites the line and prompts you with the address for the next line. A question mark means that you need to retype the line. After you enter the last line, the computer displays this line:

```
A 140B
```

To end the assembly, press RETURN on this line without typing anything else. The line at 1400 calls the print routine, which prints whatever character is in the A register. The value in that register will be set by the BASIC calling routine. The line at 1403 subtracts one from the counter value in the X register; this value is set from BASIC as well. Lines 1404–1408 say, "If the count has not hit zero, go back; otherwise, load and print a RETURN character and return to BASIC".

After you enter the program, save it to disk with the following command:

```
S "0:+ML",8,1400,140B
```

This command saves the program under the filename +ML. There's nothing magical about the plus sign (+) at the beginning of the filename. I prefer to put a special character at the start of the name of any file that is not intended to be loaded with a BASIC LOAD or DLOAD. This serves as a visual reminder of the file's special purpose when you are scanning a disk directory. Any legal Commodore filename can be used when saving files from the ML monitor. However, the BASIC program listed below expects to find a file named +ML, so you should include the plus sign for this example.

After you press RETURN, you'll see the disk light come on and hear the disk motor run. Now for a handy feature of the machine language monitor. We'll ask the disk whether or not everything went well. Type the single character @ and press RETURN. You'll get a report from the disk. There will be a number (the error type, normally 0); a message (normally OK); and

then two more numbers, which indicate the disk track and sector where the error occurred in cases where that information is relevant. If you get the OK message, your program has been saved and you're ready to proceed.

The disk commands of the machine language monitor are very useful. They are similar to those of the disk wedge programs used in other Commodore computers. For example, type @,$0 and press RETURN. You'll get the directory of your disk.

Now let's destroy the program we have just written. That way, we can confirm that our BASIC program will load it correctly from disk. We'll use the F (Fill) command to store zeros in memory locations 1400–1480:

```
F 1400 1480 0
```

The BASIC Portion

Our machine language program is gone. To exit to BASIC, type X and press RETURN. Now let's write the main program. Type NEW, then enter this program:

```
100 BANK 15
110 BLOAD "+ML"
120 IF DS<>0 THEN PRINT DS$:STOP
130 V=10
140 FOR J=1986 TO 1996
150 PRINT J;:SYS 5120,42,V
160 V=V*1.1
170 NEXT J
```

We specify bank 15 so that Kernal ROM will be visible when the machine language routine is executed. The BLOAD command brings in the program. Since we don't specify a bank, the program goes to bank 15 (which, for the addresses concerned, is the same as bank 0). Because we don't specify a starting address, the program loads at the address from which it was saved.

After the load, the program checks the disk status to make sure everything went well. The disk status reserved variable, DS, must be zero; if not, we print the status message (DS$) and stop. We don't want to SYS to a program that might not be there.

The main program plots a value that grows at 10 percent per year over 11 years. It prints each year (J) and calls the machine language routine. The operation of SYS has been enhanced in the 128's BASIC 7.0. Additional values can be added after the address; these are stored in the various microprocessor registers when the routine is executed. The SYS in line 150 places the value 42 (the character code for an asterisk) into the accumulator and the value of the variable V (which starts at 10 and grows a little for each line) into the X register. If you like, you can change the program to print a character other than the asterisk. Simply replace the number 42 with the character code for the desired symbol. Similarly, you can play around with the values of V. Remember, however, that you can only pass values less than 256 in this manner.

If you use overlay techniques, you may load your machine language program to any free memory area. Stay below location $4000 (decimal 16384), however, unless you're familiar with the fine points of the 128's banking architecture. Don't interfere with areas containing working values. Use the spare locations indicated in Figure 3.

Liberating Memory

If you need a good deal of space and want to use the overlay method, there's a trick that will liberate an extra 9K block of memory up to $4000. You can easily switch BASIC so that it starts at address $4000, leaving free space in the former BASIC program area from

Figure 1: Bank 15

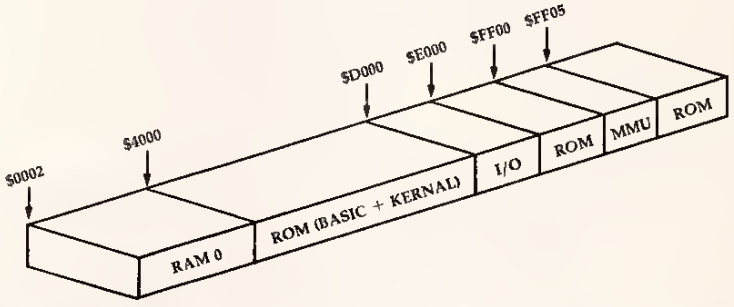


Figure 2: Bank 0

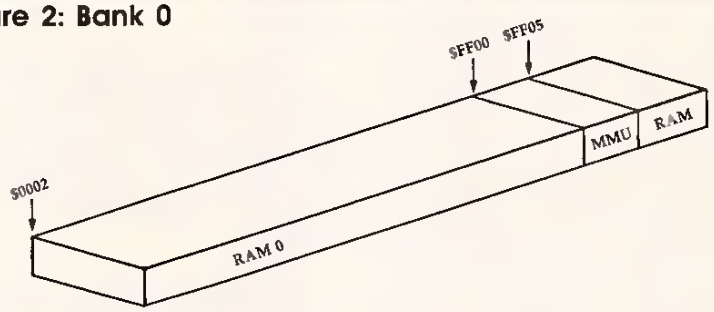
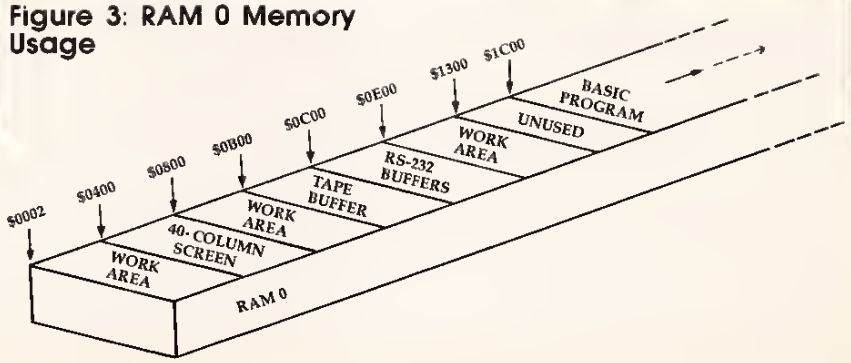


Figure 3: RAM 0 Memory Usage



$1C00 to $3FFF. Here's how to do it. At the start of your BASIC program, add the following line:

```
GRAPHIC 1:GRAPHIC 0
```

Here's how the trick works. When the GRAPHIC 1 statement is executed, BASIC is moved up to make room for a high-resolution graphics screen. BASIC now starts at location $4001. GRAPHIC 0 returns the display to the normal text screen, but the high-resolution screen area remains allocated and BASIC does not move back down. The result is lots of empty memory for you to use (this method assumes that you don't need high-resolution graphics, of course).

If you use this technique, you might like to deallocate the graphics area and restore your BASIC program's original position (starting at $1C01) when the program is finished. The command to do this is GRAPHIC CLR.

Joining To BASIC

If you don't like the extra disk activity that overlays require, you might prefer a technique that is popular on many other Commodore computers: tacking a machine language program on the end of a BASIC program. The advantage of this technique is that a single load operation brings in both the BASIC program and the machine language program. This technique works equally well with disk or tape. But there are a few points to remember.

When using this technique on other Commodore computers, you must take care not to change the BASIC program once it is in place. It's obvious when you think about it: If you add to the BASIC program, the machine language portion moves higher in memory in order to make room for the new program line(s). As a general rule, you must write the BASIC program first and refrain from changing it once it's finished.

The 128 adds another difficulty to this technique. You can't tack something on to a BASIC program if you don't know where the BASIC program is located. To explain, BASIC usually starts at $1C01, but if someone has been using graphics, the start of BASIC might be at $4001. It's no use writing a program to sit behind BASIC—at, say, location $1F80—and then discover that it sometimes loads to $4280. Chances are that it won't work in the new location, especially since it's above the dreaded $4000 barrier.

There are several ways around this problem. One is to check the start of BASIC and refuse to call the ML code if it's wrong. Another is to begin every program with GRAPHIC CLR in an attempt to move the program down to the desired area. Be careful with GRAPHIC CLR, however—it has a pitfall we'll mention in a moment.

Sample Program

Here's a small program that combines BASIC and machine language in one package. Let's write the BASIC part first:

```
100 GRAPHIC CLR
110 BANK 15
120 PRINT "SPEED TYPING"
130 PRINT "TRY TO TYPE A
    SENTENCE"
140 PRINT "END WITH RETURN"
150 SYS XXXX
160 PRINT "FAST, HUH?"
```

Do *not* run this program yet; the machine language is not in place. Now type GRAPHIC CLR to make sure the program is situated in the right part of memory. Enter the machine language monitor with MONITOR, then type this command:

```
M 2D 2D
```

The first two bytes displayed on the screen should be 01 1C. This operation confirms that BASIC does indeed start at address $1C01. Now enter this command to see where the program ends:

```
M 1210 1211
```

Depending on how you typed in the BASIC program (whether you included extra spaces, for example), you'll see a first byte with a value of about $8D and a second byte of $1C. Assuming this is the place where the program ends, you can tack on machine language anywhere after about $1C8D. To give ourselves some slack, let's pick $1CC0 as our machine language starting point. Now that you've chosen this address, type $1CC0 and press RETURN. The monitor prints +7360, indicating that the decimal value of $1CC0 is 7360. Now exit to BASIC and change line 150 as shown here:

```
150 SYS 7360
```

Now reenter the monitor and enter the following machine language program:

```
A 1CC0  JSR  $FFE4
A 1CC3  CMP  #$0D
A 1CC5  BEQ  $1CD8
```

As we write this program, we'll guess at the exit address, since we haven't gotten there yet. We can always come back to correct this address if it's not correct.

```
A 1CC7  BCC  $1CC0
A 1CC9  LDX  $+30
```

Note that the monitor changes the decimal value 30 to $1E when you press RETURN.

```
A 1CCB  JSR  $FFD2
A 1CCE  DEX
A 1CCF  BNE  $1CCB
A 1CD1  LDA  #$0D
A 1CD3  JSR  $FFD2
A 1CD6  BNE  $1CC0
A 1CD8  RTS
```

On the last line, we see that the exit address is $1CD8. If you had guessed wrongly on line 1CC5, this would be the time to go back and correct it. Now, here's the payoff. Display the end-of-BASIC pointer with the command M 1210 1211. You'll see the same addresses as before. Move the cursor back and change the display to read:

```
>01210 D9 1C .. .. ..
```

After you press RETURN, it's safe to save the entire package. When you do so, the BASIC and machine language files are saved as one block. When you reload the file, both programs come in together.

But there's a pitfall which is related to the GRAPHIC CLR command we used in the BASIC program. When you execute GRAPHIC CLR, you may reset the contents of locations $1210–$1211 back to their original values. If you use GRAPHIC CLR in a program as we've done here, be sure to save the program *before* you run it. To save the program, return to BASIC and save the program with the usual DSAVE command. Run the program and try typing a sentence; you'll be amazed to discover what a speedy typist you've become.

The next article in this series discusses bank switching and how to pass information from one bank to another. ©

64 Screen Splitter

Lou Goldstein

This Commodore 64 utility allows you to add extra sprites, mix graphics and text, and achieve other split-screen effects usually seen only in commercial software. It can be used without machine language knowledge.

Ordinarily, the Commodore 64 can display only one screen type at a time, one character set at a time, one set of sprites at a time, and so on. But imagine selecting one set of features for the upper portion of the screen and another for the lower portion. You might, for example, use high-resolution graphics above and standard text below. Or you might want a combination of eight sprites and graphics characters on top, plus extended color mode and eight more sprites on the bottom.

Such seemingly impossible split screens are easily created—if you happen to be an accomplished machine language programmer. With "64 Screen Splitter," you can manage true split screens with absolutely no knowledge of machine language. Screen Splitter adds two new commands to BASIC to permit the simultaneous display of two distinct screens of your choice. Each screen can be either high resolution or text, and can use standard, multicolor, or extended color text mode. Each can have its own colors, character set, and sprites. In short, anything you can do with a single screen, you can do with each of your two screens.

Get Ready To Split

Program 1 is the machine language for Screen Splitter, which you must enter with the "MLX" machine language entry program published elsewhere in this issue. Follow the MLX instructions carefully. When you run MLX, you'll be asked for a starting address and an ending address for the data you will be entering. Here are the addresses you will need to type in Screen Splitter:

Starting address: **C000**
Ending address: **C697**

Before using Screen Splitter, you must always reserve a safe memory area where it can store high-resolution screens and dot patterns. This is done by moving the start of BASIC program space upward in memory. BASIC workspace normally starts at location 2048. For Screen Splitter, the safest new location is 16384. Here is a short program that performs all of the setup needed to use Screen Splitter:

```
10 IF A=0 THEN A=1:LOAD "SP
   LITTER",8,1
20 SYS 49152:POKE 43,1:POKE
    44,16*4:POKE 16*1024,0
30 PRINT"{CLR}{4 DOWN}LOAD"
   CHR$(34)"MYPROG"CHR$(34)
   ",8"
40 PRINT"{4 DOWN}RUN{HOME}"
50 FOR K=631 TO 640:POKE K,
   13:NEXT
60 POKE 198,10:NEW
```

Line 10 loads Screen Splitter into memory. When you type line 10, replace SPLITTER with the name you used when saving Screen Splitter with MLX (if you are using tape instead of disk, substitute ,1,1 for ,8,1). Line 20 activates Screen Splitter with SYS 49152 and raises the start of BASIC to location 16384. Lines 30–60 are optional and should be used only if you want to load and run a BASIC program of your own (in which case, you should substitute the name of your program for MYPROG in line 30). If you don't want to load and run a program, add a NEW statement to the end of line 20 and delete lines 30–90.

Program 2 contains a brief demonstration of several Screen Splitter features. Don't forget to load and activate Screen Splitter before you load and run this program.

Split Screen Commands

Screen Splitter adds two new statements to Commodore 64 BASIC: @SCREEN and @SPLIT (note that both statements begin with an @ sign). The @SCREEN statement prepares the correct environment for a split-screen display, and @SPLIT actually makes the split screen appear. @SCREEN must always be used before @SPLIT. Here is the general syntax for @SCREEN:

@SCREEN *map, topchar, botchar, topmode, botmode*

@SCREEN takes five parameters, which can be numbers or numeric variables. The first parameter, map, can be any number from 0–4, and determines where your screens will be stored. Figure 1 shows the five different memory configurations selected by map values 0–4.

The numbers at the left of the

figure represent ranges of memory locations and have been abbreviated (8K–16K means locations 8192–16383, and so on). The memory areas shaded with ****** are free for storing definitions (dot patterns) for sprites or custom characters. Each 1K free section can contain data for as many as 128 characters, or 16 sprites.

The area marked with ////// is not usable for sprite patterns or text-screen custom characters, since it is replaced by the ROM image of the Commodore characters whenever the video chip is active. However, it can hold dot patterns of custom characters to be POKEd onto a high-resolution screen, since those POKEs can only be done when the video chip is inactive. In fact, in maps 3 and 4, the same area may be used simultaneously for standard text-screen characters and custom hi-res characters.

In maps 0 and 2, the amount of memory needed for graphics depends on your use of sprites and custom characters. In these configurations, you may be able to raise the start of BASIC to locations 8192 or 10240 instead of 16384, to make more room available for a long program or a large array.

The lower screen of map 2 consists of text written on a video matrix beginning at location 3072 instead of the usual location of 1024. To print on this screen, POKE a value of 12 into address 648; this operation tells the screen editor that the screen begins at location 3072 (12*256). To return to the normal screen, POKE a value of 4 into 648; this represents the normal screen address 1024 (4*256). After you choose the desired screen, PRINT statements work normally. However, printing and clearing the screen affect only the visible portion of the text screen.

The next two parameters for @SCREEN, topchar and botchar, set the address at which each screen will find its character definitions. Legal values are even numbers from 2–14, representing the 1K boundary where the character definitions begin. A value of 4 selects the uppercase/graphics character set. The uppercase/lowercase set requires a value of 6. Use other values to select custom character sets. Since it is not possible to PRINT directly on a hi-res screen, these parameters are ignored for hi-res work (however, you must still supply legal values for topchar and botchar). Screen Splitter does not allow you to change character sets by pressing SHIFT-Commodore.

The last two @SCREEN parameters, topmode and botmode, select the upper and lower color modes. These values should be 0 for normal colors or 1 for multicolor mode. A value of 2 (legal for text screens only) selects extended color mode.

If you execute a @SPLIT statement without previously using @SCREEN, you will get a default setup that is equivalent to @SCREEN 0,4,6,0,0 with a blue background and yellow sprites on top, and a yellow background and blue sprites below.

@SPLIT

The second new command, @SPLIT, requires one parameter, the number of lines of the upper screen to be shown. Legal values are in the range 0–25. Values from 1–24 produce split screens of varying sizes. A value of 1, for example, makes the top screen one text line (eight lines of hi-res dots) in height. The remainder of the display is allotted to the lower screen. When the @SPLIT value is 2, the top screen contains two text lines, and so on.

An @SPLIT value of 0 displays only the lower screen, and @SPLIT 25 shows only the top screen. These two configurations do more than simply make the other screen invisible: They turn Screen Splitter off completely, which increases the computer's processing speed and prevents screen flicker during tape or disk access. These configurations can be invaluable in debugging. When your program stops with an error, the error message and READY prompt may be printed on

Figure 1. Memory Allocations for @SCREEN

	Memory Map Number 0	1	2	3	4
	all 1K text	all hi-res	1K text over 3K text	1K text over hi-res	hi-res over 1K text
1K–2K	text screen	color for hi-res	upper text screen	text screen	text screen
2K–3K	********** ********** **********	********** ********** **********	********** ********** **********	********** ********** **********	********** ********** **********
3K–4K	********** ********** **********	********** ********** **********	lower text screen	color for hi-res	color for hi-res
4K–8K	// //// ROM image of uppercase-graphics characters //// // ////// ROM image of upper-lowercase characters ////// //				
8K–16K	********** ********** ********** **********	hi-res screen	********** ********** ********** **********	hi-res screen	hi-res screen

a part of the screen that is invisible to you. If you suspect this has occurred, type @SPLIT 0 or @SPLIT 25 in immediate mode (even if you have to type blind) to examine the entire text screen. In map 1, neither screen contains text, so use @SCREEN 0,4,4,0,0 to check the text screen.

Controlling Video Features

Once you've created a split screen with @SCREEN and @SPLIT, you essentially have two independent screens at your disposal. You may use any of the ordinary graphics techniques appropriate to the current configuration, keeping in mind the reduced size of each screen.

The usual way to control sprites and other video features is by POKEing values into the appropriate VIC-II control registers. A similar method is used with Screen Splitter, but the addresses are different. Instead of POKEing into the control registers themselves, you POKE mock registers and let Screen Splitter transfer the values to the actual control registers when the time is right.

There are 47 VIC-II control registers, which normally begin at location 53248. Screen Splitter provides two sets of mock control registers—one set for the upper screen and one for the lower. The 47 top screen registers begin at location 49235. The 47 mock registers for the bottom screen begin at location 49282. Whenever you POKE a new value into one of the mock registers, Screen Splitter waits until the correct time, then transfers that value into the corresponding control register.

Pointers to sprite dot patterns are normally stored in the last eight bytes of the video matrix (locations 2040–2047). But, since Screen Splitter permits as many as 16 sprites to share the screen in some configurations, it is necessary to use mock sprite pointer registers as well. The mock sprite pointers are always in the same place regardless of the screen's location. The top screen sprite pointers occupy the eight bytes beginning at location 49329. These bytes are preset to point to sprite shape locations 32–39 (locations 2048–2111 contain the data for sprite 0, the next 64 bytes contain the data for sprite 2, and so forth). The lower screen sprite pointers begin at location 49337 and point to sprite locations 40–47. Of course, you can POKE new values into these registers at any time.

At the start of each raster interrupt all the sprite pointers at the end of the current video matrix are reset to point to sprite shape location 11 (addresses 704–767, filled with zero bytes when you first activate Screen Splitter). If this occurs in the middle of a sprite, the video chip continues to send it to the screen, but since the dot pattern is blank, the rest of the sprite becomes invisible. Near the end of the interrupt, the sprite pointers for the new screen are copied into the last eight bytes of its video matrix. The video chip continues to project any remaining upper sprites, but uses the new horizontal position, color, and dot data. As a result, when an upper sprite sinks through the boundary, the bottom few lines of the corresponding lower sprite may appear just below the boundary, at the lower sprite's *x* position.

Changing the lower sprite's *y* position or even turning it off completely will not prevent this overlap problem—these controls are ignored once the chip begins projecting a sprite. So when an upper sprite is going to drop through the boundary, the same numbered sprite for the lower screen should contain a blank definition (at least for its bottom several lines), or it must be positioned off the side of the screen. Sprites rising from the lower screen are cut off at the top as they approach the boundary. But when the sprite's *y* position reaches the split point, the remaining portion of the sprite suddenly disappears.

Advanced Techniques

Most VIC-II registers control only one feature. However, locations 53265 and 53270 each control multiple functions. The @SCREEN statement initializes both of the mock registers corresponding to 53265 with a default value of 27 (three rasters of vertical fine scrolling, 25 rows, blanking off, bitmapping off, extended color off, raster bit 8 off). Both mock registers corresponding to 53270 are set to 8 (no horizontal fine scrolling, 40 columns, multicolor off). Changes are made as needed to turn on extended, multicolor, or bitmap graphics. The default settings may be changed with POKEs to address 49638 for register 53265 and 49646 for register 53270. For more information about these rarely used features, consult *Mapping the* 64, available from COMPUTE! Books, and the *Commodore* 64 *Programmer's Reference Guide.*

You can override @SPLIT's raster control with POKEs. The @SPLIT statement always sets the number of scan lines above the boundary to a multiple of eight, so that text will fit neatly on the screen. For an in-between position, adjust location 49253 to the value 48 plus the number of scan lines of upper screen you want to display. For example, this statement shows 43 scan lines of hi-res screen in the top screen:

```
POKE 49253, 43+48
```

You may also change the raster setting for the change from lower to upper screen. The normal value is 19 for an offscreen transition. But you can set location 49300 to a value greater than 48, creating a three-part screen with the bottom screen visible both below and above the top screen.

For a strange effect, POKE 49253 with a value of 19 to match the lower register. If the upper and lower screen colors are different, you will see them flicker in alternation. If the colors are the same, you will be able to see up to 16 flickering sprites at once against a steady background. Each sprite will be free to move anywhere on the screen. To display a flicker-free sprite, create a twin in the same position on the other screen.

Screen Splitter uses a delay during the interrupt to insure that any change in background color occurs between scans of the TV's electron beam. The length of the delay is controlled by location 50828, which, in turn, is set by @SCREEN. Maps 3 and 4 usually change colors early in the interrupt, when the screen type changes. @SCREEN sets location 50828 for eight passes

of the delay loop. The other maps generally change colors later, when the color registers are copied, so six passes of the delay loop are sufficient. If something in your program disrupts the timing (for example, a sprite may be located at the boundary) the color may change in the middle of a row of pixels. You can correct such an imperfection by changing the value in location 50828.

Most VIC-II registers are intended to be POKEd rather than PEEKed. But four control registers are usually read: locations 53267–53268 for the light pen, and locations 53278–53279 for sprite collisions. Splitter ignores these locations, so you can PEEK them as usual. However, the VIC-II has no way to tell whether a collision involves upper or lower sprites. If there is any possibility of confusion on this point, your program must analyze the sprite positions to clear it up.

Program 1. Screen Splitter

Please refer to the "MLX" article in this issue before entering the following listing.

```
C000:AD 15 03 C9 CF 90 0C AD 21
C008:14 03 8D C3 C0 AD 15 03 2C
C010:8D C4 C0 78 A0 06 89 46 FF
C018:C0 99 03 03 88 D0 F7 58 C0
C020:A9 08 20 D2 FF A2 3F A9 5C
C028:00 9D C0 02 CA E0 FF D0 F3
C030:F8 60 40 53 43 52 45 45 86
C038:CE D0 40 53 50 4C 49 D4 AD
C040:D1 00 00 32 C0 3A C0 3D 7B
C048:C1 E2 C0 18 C1 06 C4 B8 65
C050:C1 50 C3 00 00 00 00 00 3F
C058:00 00 00 00 00 00 00 00 D9
C060:00 00 00 00 1B 80 00 00 8C
C068:00 08 00 14 01 01 00 00 39
C070:00 00 00 06 06 00 00 00 82
C078:00 00 08 08 08 08 08 08 F3
C080:08 08 00 00 00 00 00 00 08
C088:00 00 00 00 00 00 00 00 0A
C090:00 00 00 18 13 00 00 00 5C
C098:08 00 16 01 01 00 00 00 F8
C0A0:00 00 08 08 00 00 00 00 A3
C0A8:00 06 06 06 06 06 06 06 27
C0B0:06 20 21 22 23 24 25 26 9D
C088:27 28 29 2A 2B 2C 2D 2E 32
C0C0:2F 00 00 00 00 00 00 00 D9
C0C8:00 00 00 00 00 00 00 00 4A
C0D0:00 A9 2C A0 00 D1 7A F0 79
C0D8:05 A2 0B 6C 00 03 20 9B 95
C0E0:B7 60 08 2C 0F 00 30 0A FC
C0E8:C9 D0 90 06 C9 D2 B0 02 F2
C0F0:90 04 28 4C 1A A7 8C 49 57
C0F8:00 28 38 E9 D0 0A A8 B9 E3
C100:43 C0 85 FD B9 44 C0 85 CB
C108:FE A0 00 81 FD 30 06 20 2B
C110:D2 FF C8 D0 F6 4C EF A6 92
C118:20 73 00 C9 D0 90 06 C9 C3
C120:D2 80 02 90 06 20 79 00 26
C12B:4C E7 A7 38 E9 D0 0A A8 93
C130:89 4F C0 85 FD B9 50 C0 0D
C138:85 FE 6C FD 00 20 7C A5 CA
C140:A0 00 B9 00 02 F0 0C C9 01
C148:22 F0 16 C9 40 F0 1E C8 43
C150:4C 42 C1 99 02 02 E8 C8 0F
C158:C8 C8 C8 A9 FF 84 71 C8 E3
C160:60 C8 B9 00 02 F0 EC C9 F4
C168:22 F0 E4 D0 F4 84 FC A2 39
C170:00 8D 32 C0 29 7F D9 00 80
C178:02 D0 0A 8D 32 C0 30 1A 5D
C180:E8 C8 4C 71 C1 8D 32 C0 75
C188:30 03 E8 D0 F8 E8 E8 A4 F0
C190:FC 8D 32 C0 D0 DB C8 4C 28
C198:42 C1 E8 BD 32 C0 C8 A6 73
C1A0:FC 9D 00 02 E8 B9 00 02 5A
C1A8:9D 00 02 F0 05 C8 E8 4C B3
C1B0:A5 C1 A4 FC C8 4C 42 C1 99
C1B8:20 DE C0 8E C6 C0 20 41 8F
C1C0:C3 20 D1 C0 8E C7 C0 20 A9
C1C8:30 C3 20 D1 C0 8E C8 C0 09
C1D0:20 30 C3 20 D1 C0 8E C9 63
C1D8:C0 20 48 C3 20 D1 C0 8E C2
C1E0:CA C0 20 4B C3 A9 1B 8D 3B
C1E8:CB C0 8D CE C0 A9 08 8D 68
C1F0:CC C0 8D CF C0 A9 06 8D FF
C1F8:8C C6 A0 0F A2 07 AD C6 CC
C200:C0 D0 11 A9 10 8D CD C0 E9
C208:8D D0 C0 8E 2D C5 8E 6E 95
C210:C6 4C 80 C2 C9 01 D0 1B 57
C218:A9 20 0D C8 C0 8D C8 C0 6D
C220:A9 20 0D CE C0 8D CE C0 A8
C228:A9 18 8D CD C0 8D D0 C0 B5
C230:4C 08 C2 C9 02 D0 13 A9 86
C238:10 8D CD C0 A9 30 8D D0 E8
C240:C0 8E 2D C5 8C 6E C6 4C C3
C248:80 C2 A9 08 8D 8C C6 C9 6A
C250:03 D0 15 A9 10 8D CD C0 D8
C258:A9 20 0D CE C0 8D CE C0 E3
C260:A9 38 8D D0 C0 4C 41 C2 04
C268:A9 10 8D D0 C0 A9 20 0D 7F
C270:CB C0 8D C8 C0 A9 38 8D 25
C278:CD C0 8C 2D C5 8E 6E C6 85
C280:AE C7 C0 AD CB C0 29 20 16
C288:D0 07 8A 0D CD C0 8D CD 84
C290:C0 AE C8 C0 AD CE C0 29 9A
C298:20 D0 07 8A 0D D0 C0 8D A6
C2A0:D0 C0 AD C9 C0 F0 21 C9 E6
C2A8:02 D0 15 AD C8 C0 29 20 B4
C2B0:F0 03 4C 46 C3 AD C8 C0 8A
C288:09 40 8D CB C0 4C C8 C2 CC
C2C0:A9 10 0D CC C0 8D CC C0 24
C2C8:AD CA C0 F0 21 C9 02 D0 04
C2D0:15 AD CE C0 29 20 F0 03 E0
C2D8:4C 46 C3 AD CE C0 09 40 35
C2E0:8D CE C0 4C EE C2 A9 10 A3
C2E8:0D CF C0 8D CF C0 AD C8 82
C2F0:C0 8D 64 C0 AD CD C0 8D 86
C2F8:68 C0 AD CC C0 8D 69 C0 86
C300:AD CE C0 8D 93 C0 AD D0 CE
C308:C0 8D 9A C0 AD CF C0 8D 6E
C310:98 C0 AD 2D C5 AE 6E C6 29
C318:A0 02 8D 08 C4 8E 4C C5 91
C320:C8 C8 C8 C0 1A D0 F3 8D EC
C328:8C C3 8E D8 C3 4C AE A7 E2
C330:8A F0 13 6A 90 03 4C 46 81
C338:C3 E0 0F 90 03 4C 46 C3 5E
C340:60 E0 05 B0 01 60 A2 0E 88
C348:6C 00 03 E0 03 4C 43 C3 08
C350:20 DE C0 8E C6 C0 E0 00 98
C358:F0 09 E0 19 F0 0B 90 0F 2C
C360:4C 46 C3 20 C4 C3 4C AE 96
C368:A7 20 A5 C3 4C AE A7 8A 83
C370:0A 0A 0A 18 69 30 8D 65 CE
C378:C0 A9 7F 8D 0D DC 78 A9 0A
C380:C4 8D 15 03 A9 06 8D 14 35
C388:03 AD 94 C0 8D 12 D0 AD 9F
C390:11 D0 29 7F 8D 11 D0 A9 ED
C398:0F 8D 19 D0 A9 01 8D 1A C1
C3A0:D0 58 4C AE A7 20 E3 C3 64
C3A8:A2 2E BD 53 C0 9D 00 D0 47
C3B0:CA E0 FF D0 F5 A0 07 B9 DC
C3B8:B1 C0 99 F8 07 88 C0 FF E7
C3C0:D0 F5 58 60 20 E3 C3 A2 F9
C3C8:2E 8D 82 C0 9D 00 D0 CA 8C
C3D0:E0 FF D0 F5 A0 07 89 B1 88
C3D8:C0 99 F8 07 88 C0 FF D0 CE
C3E0:F5 58 60 2C 11 D0 10 F8 30
C3E8:78 AD C3 C0 8D 14 03 AD 0D
C3F0:C4 C0 8D 15 03 A9 00 8D 5A
C3F8:6D C8 8D 9C C0 8D 1A D0 24
C400:A9 81 8D 0D DC 60 78 A9 44
C408:0B 8D F8 07 8D F9 07 8D F9
C410:FA 07 8D FB 07 8D FC 07 B9
C418:8D FD 07 8D FE 07 8D FF D0
C420:07 20 88 C6 AD 77 C0 48 28
C428:AD 76 C0 48 AD 75 C0 48 CF
C430:AD 74 C0 48 AD 73 C0 48 4F
C438:AD 64 C0 AE 69 C0 AC 68 C7
C440:C0 8D 11 D0 8E 16 D0 8C 87
C448:18 D0 68 8D 20 D0 68 8D 9A
C450:21 D0 68 8D 22 D0 68 8D 37
C458:23 D0 68 8D 24 D0 AD 53 A0
C460:C0 8D 00 D0 AD 54 C0 8D 88
C468:01 D0 AD 55 C0 8D 02 D0 C2
C470:AD 56 C0 8D 03 D0 AD 57 65
C478:C0 8D 04 D0 AD 58 C0 8D 31
C480:05 D0 AD 59 C0 8D 06 D0 25
C488:AD 5A C0 8D 07 D0 AD 58 A2
C490:C0 8D 08 D0 AD 5C C0 8D D9
C498:09 D0 AD 5D C0 8D 0A D0 87
C4A0:AD 5E C0 8D 08 D0 AD 5F DF
C4A8:C0 8D 0C D0 AD 60 C0 8D 82
C4B0:0D D0 AD 61 C0 8D 0E D0 E9
C488:AD 62 C0 8D 0F D0 AD 63 1D
C4C0:C0 8D 10 D0 AD 6A C0 8D 43
C4C8:17 D0 AD 6E C0 8D 1B D0 F1
C4D0:AD 6F C0 8D 1C D0 AD 70 ED
C4D8:C0 8D 1D D0 AD 78 C0 8D 35
C4E0:25 D0 AD 79 C0 8D 26 D0 D7
C4E8:AD 7A C0 8D 27 D0 AD 78 2C
C4F0:C0 8D 28 D0 AD 7C C0 8D 8E
C4F8:29 D0 AD 7D C0 8D 2A D0 3A
C500:AD 7E C0 8D 2B D0 AD 7F 6A
C508:C0 8D 2C D0 AD 80 C0 8D 68
C510:2D D0 AD 81 C0 8D 2E D0 9D
C518:AD 65 C0 8D 12 D0 A9 01 EC
C520:8D 19 D0 8D 1A D0 A2 07 0C
C528:8D 81 C0 9D F8 07 CA E0 4B
C530:FF D0 F5 AD 68 C0 8D 15 FF
C538:D0 A9 C5 8D 15 03 A9 47 77
C540:8D 14 03 58 6C C3 C0 78 E9
C548:A9 0B 8D F8 07 8D F9 07 16
C550:8D FA 07 8D FB 07 8D FC 2F
C558:07 8D FD 07 8D FE 07 8D FE
C560:FF 07 20 88 C6 AD A6 C0 65
C568:48 AD A5 C0 48 AD A4 C0 47
C570:48 AD A3 C0 48 AD A2 C0 0B
C578:48 AD 93 C0 AE 98 C0 AC 18
C580:9A C0 8D 11 D0 8E 16 D0 0A
C588:8C 18 D0 68 8D 20 D0 68 F7
C590:8D 21 D0 68 8D 22 D0 68 CA
C598:8D 23 D0 68 8D 24 D0 AD A0
C5A0:82 C0 8D 00 D0 AD 83 C0 54
C5A8:8D 01 D0 AD 84 C0 8D 02 74
C5B0:D0 AD 85 C0 8D 03 D0 AD 94
C5B8:86 C0 8D 04 D0 AD 87 C0 86
C5C0:8D 05 D0 AD 88 C0 8D 06 81
C5C8:D0 AD 89 C0 8D 07 D0 AD 3D
C5D0:8A C0 BD 08 D0 AD BB C0 19
C5D8:8D 09 D0 AD 8C C0 8D 0A EE
C5E0:D0 AD 8D C0 8D 08 D0 AD E5
C5E8:8E C0 8D 0C D0 AD 8F C0 78
C5F0:8D 0D D0 AD 90 C0 8D 0E 2C
C5F8:D0 AD 91 C0 8D 0F D0 AD 8E
C600:92 C0 8D 10 D0 AD 99 C0 EA
C608:8D 17 D0 AD 9D C0 8D 1B 3D
C610:D0 AD 9E C0 8D 1C D0 AD 7D
C618:9F C0 8D 1D D0 AD A7 C0 76
C620:8D 25 D0 AD A8 C0 8D 26 3C
C628:D0 AD A9 C0 8D 27 D0 AD 23
C630:AA C0 8D 28 D0 AD AB C0 CC
C638:8D 29 D0 AD AC C0 8D 2A 79
C640:D0 AD AD C0 8D 28 D0 AD CB
C648:AE C0 8D 2C D0 AD AF C0 2F
```

```
C650:8D 2D D0 AD 80 C0 8D 2E 86
C658:00 AD 94 C0 8D 12 00 A9 58
C660:01 8D 19 D0 8D 1A D0 A2 18
C668:07 8D 89 C0 9D F8 07 CA D5
C670:E0 FF D0 F5 AD 97 C0 8D C2
C678:15 D0 A9 C4 8D 15 03 A9 B6
C680:06 8D 14 03 68 A8 68 AA 88
C688:68 58 40 A2 06 CA 10 FO 0C
C690:EA EA 60 00 00 00 00 00 5A
```

Program 2. Split Screen Demo

For instructions on entering this listing, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

```
MJ 10 PRINT"{CLR}{2 DOWN}
      {13 RIGHT}PLEASE WAIT"
JO 20 FORA=8192TO14192:POKEA,0
      :NEXT
SG 30 FORX=100TO200:Y=30:GOSU8
      510:Y=90:GOSUB510:NEXT:F
      ORY=30TO90:X=100:GOSU851
      0
8F 40 X=200:GOSU8510:NEXT
CF 50 FORK=2048TO2111:POKEK,25
      5:NEXT
DH 60 8R=49282:TR=49235:POKEBR
      +33,14:POKETR+33,6:POKE6
      46,1:POKETR+32,8:POKEBR+
      32,8
Q8 70 POKE648,4:@SCREEN0,4,6,0
      ,0:@SPLIT12:PRINT"{CLR}"
FE 80 TY=95
GA 90 POKETR,200:POKETR+21,1
JG 100 FORK=1TO80
DJ 110 TY=TY+1
GK 120 POKETR+1,TY
H8 130 FORJ=1TO30:NEXT:NEXT
PP 140 POKETR+21,0
SB 150 PRINT"{8 DOWN}NOTICE TH
       E CHANGING CHARACTER SE
       TS"
PX 160 PRINT"{6 DOWN}ABOVE AND
        BELOW THE SPLIT."
CO 170 FORK=1TO3
HX 180 @SCREEN0,6,4,0,0
QJ 190 FORJ=1TO700:NEXT
AQ 200 @SCREEN0,4,6,0,0
HX 210 FORJ=1TO700:NEXT
OE 220 NEXT:PRINT"{CLR}"
SP 230 POKE648,12:PRINT"{CLR}"
       :@SCREEN2,4,4,0,0:@SPLI
       T19
DM 240 POKE8R+33,14:POKETR+33,
       14:POKE646,6
CJ 250 POKE648,4:PRINT"{CLR}
       {2 OOWN}THIS IS MAP NUM
       BER 2.{DOWN}"
PH 260 PRINT"THE TOP IS ON THE
        1K TEXT SCREEN.
KK 270 PRINT"THE 80TTOM IS ON
       {SPACE}THE 3K TEXT SCRE
       EN.
RD 280 POKE648,12
GS 290 PRINT"{17 DOWN}"
PR 300 PRINT"WATCH WHAT HAPPEN
       S WHEN I REACH THE
R8 310 PRINT"BOTTOM OF THE SCR
       EEN.
CG 320 FORK=1TO9:PRINTK"******
        SCROLLING *****":FORJ=
       1TO600:NEXTJ,K
RB 330 POKE648,4:PRINT"{CLR}
       {3 DOWN}WHERE DID THE O
       THER LINES GO???{DOWN}"
SK 340 PRINT"I'LL EXECUTE @SPL
       IT 0 SO YOU CAN SEE.":F
       ORK=1TO2000:NEXT:@SPLIT
       0
CF 350 FORK=1TO2000:NEXT:@SPLI
       T19
BG 360 PRINT"{CLR}{3 DOWN}PRES
       S ANY KEY AND I'LL CLEA
       R THE BOTTOM SCREEN ONL
       Y.":POKE198,0
EA 370 GETA$:IFA$=""THEN370
KX 380 POKE648,12:PRINT"{CLR}"
EA 390 FORK=1TO2000:NEXT:@SPLI
       T25:@SCREEN4,4,4,0,0:PO
       KE648,4
ER 400 PRINT"{CLR}{22 DOWN}NOW
        WE WILL ENTER MAP #4,
       {SPACE}A HIRES
MH 410 PRINT"UPPER SCREEN, WIT
       H A TEXT SCREEN
GJ 420 PRINT"BELOW.{2 SPACES}T
       HERE'S A HIRES PICTURE
SR 430 PRINT"ON THE SCREEN NOW
       . PRESS A KEY
FK 440 PRINT"AND I'LL SHOW IT
       {SPACE}TO YOU.
EC 450 PRINT"PRESS AGAIN, AND
       {SPACE}I'LL COME BACK."
       :POKE198,0
QR 460 GETA$:IFA$=""THEN460
AA 470 @SPLIT16
AM 480 GETA$:IFA$=""THEN480
FH 490 @SPLIT0:PRINT"{3 DOWN}T
       HIS ENDS THE DEMONSTRAT
       ION."
AJ 500 PRINT"{DOWN}FEEL FREE T
       O CONTINUE IN IMMEOIATE
        MODE.":END
FG 510 CH=INT(X/8):RO=INT(Y/8)
       :LN=YAND7:BY=8192+RO*32
       0+8*CH+LN:8I=7-(XAND7)
KM 520 POKE8Y,PEEK(8Y)OR(2↑BI)
       :RETURN
```

Programming the TI

C. Regena

More Solitaire

This month's article and listing continue the game program, "Solitaire", started in last month's column. Although last month's listing included enough of the game to play, all the features had not been included. This month we'll add a way to keep track of each move so you can back up if you want or have the computer replay the whole game or print the moves with a printer.

Keep in mind as you are doing your own programming that there are many ways to accomplish the same thing (and most of the time it doesn't matter which method you choose). Some ways may be more sophisticated or more efficient. In this game I selected the techniques I thought would be easiest to understand. First, let's go back and see how to tell if you are making a legal move.

A Less Complicated Array

To move a peg, you must choose a peg, then jump over one (and only one) peg into a vacant place, or hole. I decided to use an array of numbers where the number 1 represents a peg's location and the number 0 represents a hole. For each location there is a row and a column. This array is the G array. The playing area is shaped like a cross, so there are locations that cannot be used. Rather than define a smaller, more complex array, I used all the elements of the array and used the number 2 for positions off the playing area—where pegs cannot be. I needed two spots around each peg to test the valid jumps, so there are two rows and two columns beyond each peg on the playing surface. The G array thus starts with the zero elements and goes to (12,12). The DATA statements in lines 340–460 define the elements for the starting game board. The border elements contain a 2; a peg is 1; and a hole is 0.

Each position is represented by a row R and a column C. The actual

row and column on the screen are calculated by lines 820–830. Lines 850–1090 blink the peg or hole position while waiting in a CALL KEY loop for an arrow key or the ENTER key to be pressed. When an arrow key is pressed, the IF statements make sure the move is still within the playing area. If the G element is a 2, the peg cannot go in that direction.

The program branches to line 1100 if the ENTER key is pressed, and line 1110 makes sure a peg is there to move. Lines 1120–1540 detect the arrow key pressed for the direction of the jump, and the IF statements make sure there is an adjacent peg, then a hole. If a jump cannot be made, there is a low tone and the program branches back to line 850. If a jump can be made, the graphics change and the G elements are updated: The peg moves to a hole and leaves a hole in the first position, and the jumped peg is removed and a hole is shown there.

Keeping Track Of The Moves

The program then branches back to the CALL KEY loop for the next move. This process continues (indefinitely). By the way, you may want to add a routine to check for the end of a game—my program just stays in this loop.

Now let's add a way to keep track of the moves. Since the locations are designated by a row number and a column number, I decided to trace the move by making (R,C) the first position and (R2,C2) the new one. These moves are in the M$ array. To simplify further, by subtracting one from the row or column number used in the G array, all locations will be one-digit numbers. Therefore, the M$ string will be a four-digit number. For example, M$(5) might be 5351, which indicates the peg in (5,3) moves to (5,1). The top row of the cross shape is row 1, and the leftmost column is column 1. The center hole is (5,5).

Add line 795 to start with move 1. Line 1514 increments the number of the move. Lines 1115 and 1512 record the row and column numbers of the starting position and ending position of valid moves.

Lines 892–896 and 1152–1156 are added to detect a key press of REDO (FCTN-3), BEGIN (FCTN-5), or FCTN-P for print. Lines 1600–1760 are added to back up one move. Lines 1800–1980 are added to have the computer show how you played the whole game (or a game up to the present position). Lines 1990–2110 print the sequence of moves.

Variable Retracing

With a record of moves in M$, you can back up—or back up a number of moves. M$ is redefined as F$, then taken apart with the SEG function to get the row and column positions. To back up, a hole is printed in the second location and a peg in the first position. You also need to put a peg back in the position between these two listed positions. SGN is used to figure out the direction between the two locations. If the row is constant, SGN will return 0 and SGN(C2−C) will be 1 or −1 for the middle peg. If C and C2 are the same, then SGN (R2−R) will be 1 or −1. Line 1700 shows the peg on the screen. Lines 1730–1750 reset the G elements.

To have the computer show the game from the start, the screen clears and the original game board is shown. Lines 1820–1960 loop for the first move to the present move. After each move the player must press the space bar to continue. After all the moves are shown, the program is ready for the player to continue playing.

To print the sequence of moves, be sure to put your own printer configuration on line 2010. Line 2080 simply prints a move number, then the first position and second position (using coordinates).

If you wish to save typing effort, you may receive a copy of this (complete) program by sending a copying fee of $3 plus a stamped, self-addressed mailer and a blank cassette or disk to C. Regena, P. O. Box 1502, Cedar City, UT 84720. Please specify the title, "Solitaire" for the TI-99/4A.

Note: This listing is incomplete. Start by loading Solitaire from last month's column; then add these lines. You should then save a copy of the complete program.

```
105 REM  SOLITAIRE PART 2
795 M=1
892 IF K=6 THEN 1600
894 IF K=14 THEN 1800
896 IF K=34 THEN 2010
1115 N$=STR$(R-1)&STR$(C-1)
1152 IF K=6 THEN 1600
1154 IF K=14 THEN 1800
1156 IF K=34 THEN 2010
1512 M$(M)=N$&STR$(R-1)&STR
     $(C-1)
1514 M=M+1
1600 M=M-1
1610 IF M>0 THEN 1640
1620 CALL SOUND(200,130,2)
1630 GOTO 850
1640 F$=M$(M)
1650 R=VAL(SEG$(F$,1,1))+1
1660 C=VAL(SEG$(F$,2,1))+1
1670 R2=VAL(SEG$(F$,3,1))+1
1680 C2=VAL(SEG$(F$,4,1))+1
1690 CALL HCHAR(R2*2,C2*2+4
     ,105)
1700 CALL HCHAR((R+SGN(R2-R
     ))*2,(C+SGN(C2-C))*2+4
     ,97)
1710 CALL HCHAR(R*2,C*2+4,9
     7)
1730 G(R,C)=1
1740 G(R2,C2)=0
1750 G(R+SGN(R2-R),C+SGN(C2
     -C))=1
1760 GOTO 820
1800 GOSUB 620
1810 PRINT :"PRESS SPACE FO
     R NEXT MOVE"
1820 FOR T=1 TO M-1
1830 F$=M$(T)
1840 R=VAL(SEG$(F$,1,1))+1
1850 C=VAL(SEG$(F$,2,1))+1
1860 CALL HCHAR(R*2,C*2+4,9
     8)
1870 CALL SOUND(100,1048,2)
1880 R2=VAL(SEG$(F$,3,1))+1
1890 C2=VAL(SEG$(F$,4,1))+1
1900 CALL HCHAR(R2*2,C2*2+4
     ,98)
1910 CALL HCHAR((R+SGN(R2-R
     ))*2,(C+SGN(C2-C))*2+4
     ,105)
1920 CALL HCHAR(R*2,C*2+4,1
     05)
1930 CALL HCHAR(R2*2,C2*2+4
     ,97)
1940 CALL KEY(0,K,S)
1950 IF K<>32 THEN 1940
1960 NEXT T
1970 CALL HCHAR(23,3,32,25)
1980 GOTO 820
1990 REM  PUT YOUR PRINTER
2000 REM  CONFIGURATION HER
     E
2010 OPEN #1:"RS232.BA=600"
2020 FOR T=1 TO M-1
2030 F$=M$(T)
2040 R$=SEG$(F$,1,1)
2050 CC$=SEG$(F$,2,1)
2060 R2$=SEG$(F$,3,1)
2070 C2$=SEG$(F$,4,1)
2080 PRINT #1:T,R$;",";CC$;
     " TO ";R2$;",";C2$
2090 NEXT T
2100 CLOSE #1
2110 GOTO 820
2200 END                    ©
```

The World Inside the Computer

Fred D'Ignazio, Associate Editor

Boy Shoppin' With Taunnie Howery

Taunnie Howery is about to release her first pop single. The name of the single, "Boy Shoppin'," will also be the name of Taunnie's first LP, to be released later this fall. Taunnie wrote and recorded "Boy Shoppin' " for her older sister Shanna, 15. "It's about girls going out on Friday nights looking for gorgeous guys," says Taunnie. "I wrote it for Shanna; she's kind of like that."

Taunnie is only 12 years old, but she has been making music for a long time. Her parents bought her a piano when she was only 2 years old. At age 3-1/2, Taunnie composed her first song, and she has been writing music ever since. She still plays the piano, but now she adds music from an electronic organ, drum machine, electric guitar, and several keyboard synthesizers.

Taunnie's dad, Clint, has built her a professional recording studio in the garage that connects to the back of their house. The family laundry room has become a studio control room. Taunnie has wanted to record her own album since she was 6 years old, but this seemed impossible until now. Not only was she just one person, amidst dozens of highly technical machines, but she was also blind. How could a blind child operate her own recording studio and record her own songs?

Taunnie and her parents didn't give up. Clint joined with Robert Artusy, a programmer who was working with blind people at the University of California at Berkeley, on a voice I/O system for computers. Together the two of them created the Pro Inovator MK I—a talking, musical computer that a blind person can control by giving verbal commands. Clint set up a Pro Inovator in Taunnie's garage studio, and Taunnie went to work composing and recording "Boy Shoppin'."

Who Needs A Keyboard?

Taunnie can control the entire studio from one location. She doesn't have to get up and try to find buttons or read a screen. She doesn't even need a keyboard. According to Taunnie, "It just gets in my way."

Taunnie talks to the computer and tells it settings for her musical instruments. The computer talks back and tells her the status of everything in the room. She uses an array of foot pedals to remotely operate multitrack recorders, mixers, and other devices in the control room. By singing through a delay box, Taunnie can harmonize with her own voice, create different voices, and give her voices special effects, reverberations, and echoes.

The heart of Taunnie's studio is the Pro Inovator. It's based on an IBM PC–compatible computer with a 48-channel, 16-track MIDI interface, a 20-megabyte hard disk drive and 640K of RAM. With this system, which costs less than $2000, Taunnie can mix together 32 musical instruments in any combination.

The voice recognition and speech synthesis software built into the Pro Inovator is the product of four years of effort by Robert Artusy and a dedicated group of blind people. Together they created something that is far more than a talking computer. According to Artusy, "My team of blind consultants worked very hard to help me design a product that would meet a blind person's needs. First, it had to be affordable, since the average blind person makes less than $3500 a year. Second, it had to run commercial software and use off-the-shelf hardware products. Third, it had to enable a blind or physically challenged person to review anything on the computer screen. Last, it had to be part of a lifelong learning and productivity system for blind people."

Not Only For Music

By using a DECTalk stand-alone speech synthesizer, Artusy was able to create an understandable computer voice with a 25,000-word vocabulary at a fraction of the cost of a digitized speech system. The entire product—including synthesizer, voice recognition and synthesis software, and cable—costs less than $1,000. "A blind person can take this equipment, hook it up to an IBM-compatible computer at home, school, or work," says Artusy. "He or she can do word processing, create databases and spreadsheets, and do anything else people normally do with computers. With this system a person can hold down a computer-related job or go to high school or college."

After her first album is released, Taunnie Howery is looking forward to additional challenges. "My biggest goal in life," says Taunnie, "is to reach people through music." To that end, she has appeared on the TV program "That's Incredible" and worked with Dudley Moore and Christina Crawford on charity benefits for abused and neglected children. She and her mother Diane are now putting together a band composed entirely of disadvantaged people. "We'll show physically challenged people you can do great things if you just make up your mind and go for it."

For more information about Robert Artusy's voice recognition/speech synthesis system, write Enable Talking Software, 1510 E-4 Walnut Avenue, Berkeley, CA 94709, or call 415/540-0389. For more information about the Pro Inovator computer, write Professional Innovations, 2828 Cochran Street, Suite 284, Simi Valley, CA 93063, or call 805/581-2078. ©

Computers and Society

David D Thornburg, Associate Editor

A Nation Of Thieves?

Judging from articles appearing in some of the trade magazines these days, software piracy is becoming a big business. The most conservative estimate I've seen suggests that piracy cost the industry $168 million in 1984 alone. Estimates for 1985 losses are in the $800-million range.

According to industry observers, piracy is largely restricted to software that runs on personal computers, and the bulk of the loss comes from individuals who make copies as "gifts" for others rather than from organized counterfeiters who operate their thievery for profit.

Reasons For Copying

In the past few months I have corresponded with many people who make illicit copies of software. In many cases, these people feel that software is not "property" in the normal sense of the word, and that making a copy doesn't hurt anyone. "Sure I use copied software," one person wrote; "I wasn't going to buy it anyway, so who loses?" Another common argument is that the copy is merely for "testing," and, if the program is any good, a legitimate copy will be purchased from the manufacturer. Still another argument arises: "Most software is overpriced, and I paid enough for my computer, so why should I have to pay for software too?"

One of my favorites among the arguments is: "When I make copies, I am giving free advertising to the software vendor. They should thank me!"

Computer software is not the only victim of this mentality. The popularity of dual-bay tape recorders with "auto-dubbing" features is taken by many to be an indication that we have become a nation of copiers. The copying of audio recordings is thought to be so pervasive that the U.S. Senate has proposed a bill (S. 1739) that would impose a 5-percent royalty tax on all tape recorders, a 25-percent tax on dual-bay recorders, and a $1 (per cassette) tax on blank tapes. It is possible, if software vendors were to form a powerful lobbying organization, that similar legislation would be proposed for computers as well.

Imagine having to pay a special tax when you purchase a second disk drive, or whenever you buy blank disks!

I don't like this proposed legislation for two reasons. First, it penalizes those who do not copy, and second, it provides legitimacy to those who do. Once such a tax goes into effect, it will be easy for people to justify copying by saying, "I already paid my copying tax, so why shouldn't I do it?"

Industry's Response

If the software industry hasn't gotten special legislation enacted, it has tried many other ways to cut down on illicit copying. The most popular method involves *copy-protection* of the disk.

By making disks hard to copy, vendors hope to cut down on the number of "free" copies floating around the user community. In fact, virtually every copy-protection scheme can be broken within a half-hour by anyone who wants to take the time to do it. The real consequence of copy-protection is that legitimate users are burdened with problems when they make legitimate backup copies of a disk, or when they try to install their product on a hard disk. Many vendors allow their product to be copied to a backup disk or to a hard disk, but then require that a master disk be inserted each time the program is booted. This penalizes the honest user who wants to reconfigure the computer system, or who wants to place software on a hard disk drive. The person who makes illicit copies has no such penalty since, once the copy-protection is broken, new copies have no protection at all.

New schemes are being proposed weekly to solve this problem, but I think that copy-protection approaches the problem from the wrong angle.

A Different Approach

Call me naïve if you wish, but I'd like to think that people could be kept from copying software because it is wrong to do so, not because it is too difficult to do. Rather than invest time and energy in copy-protection schemes that are expensive to implement, that penalize honest users, and that can be broken in a short time anyway, I'd rather see the industry launch an educational effort to let the public know that software can be protected under Federal copyright law and that the unauthorized copying of this software is a Federal offense.

Quite simply, it is against the law to copy software.

A second prong in this educational effort would be to help the public understand that software theft is not a "victimless crime," that the loss of revenue can lead and has led to the bankruptcy of software developers. The real tragedy is that, since it is the good software that gets copied, it's the good, innovative developers being driven out of the business.

I feel certain that, once people come to realize the negative consequences of their copying, copy-protection can become a thing of the past. And if it is not enough to say that software copying is a violation of Federal law (which it is), it should be enough to say that we shouldn't copy software simply because it isn't fair to the people who created it in the first place.

David Thornburg enjoys hearing from readers and may be reached in care of this magazine.

Telecomputing Today

Arlan R. Levitan

Fighting The Bloat Factor

Rapid change is one of the few constants in the world of personal computing. In a little over five years, the average personal computer's memory size has grown from about 48,000 bytes to more than one-half million bytes of storage, with one- and two-megabyte memories becoming common. Once the province of well-heeled small business computing, 40-megabyte hard disk drives are well within the reach of the average yuppie's pocketbook.

During this time, the average speed of computer hobbyist modems has barely kept pace. It has moved from 300 to 1200 bits per second (bps) over the past few years. While 2400 bps modems are now in vogue, far higher transmission speeds will be required by the average user in the future. Even now, the amount of computerized data we are likely to handle can be overwhelming.

This point was driven home rather forcibly to me the other day. I had decided to download four days of messages from the Atari ST special interest group on one of the commercial information services. I played it smart (or so I thought) by not pausing to read individual messages, instead capturing all the messages in a steady stream. I settled back in a lounge chair, put a new recording on the stereo, and closed my eyes for a moment....

No Smiles

I was rudely awakened by the bell signal from the computer which indicates that it has finished the download and logged off the information service. I sat down and gawked bleary-eyed at the screen. The sign-off message said that I had been on the system for almost an hour. Was that possible? I exited the terminal program to check the size of the downloaded message file. It consisted of a whopping 245K of text. With a healthy amount of trepidation, I loaded the document into a word processor that reputedly can take advantage of my ST's megabyte of memory. While the file did load, the word processor's performance was decidedly on the slothful side. Just for fun, I tried some global search and change operations. I stopped grinning when I found that each operation took several minutes.

Both my machine and I were victims of information overload, and more of the same is just around the corner for purchasers of so-called state-of-the-art microcomputers. Larger memory sizes encourage larger (and often less efficient) programs. Forget about 8K gems such as the original *Star Raiders* for the Atari 400 and 800. Say goodbye to the "huge" 128K address space of the Commodore 128. Bid a fond farewell to the ho-hum 640K of an IBM PC. There is already talk that serious software for the Amiga, Atari ST, Macintosh, and even PC will soon require at least a million bytes of memory (if not 2 or 4 megabytes) and third-generation versions of the microprocessor chips those machines use today.

Think I'm stretching things? Apple Computer recently posted a new version of the Mac's operating system on the commercial information services two weeks before it was to be distributed to dealers. I was tempted to download all of the files involved—a total of 978,000 bytes—until I took a closer look at what it would cost. Assuming the 75 character-per-second throughput rate I usually experience on that particular service, it would take 3½ hours to download the entire package—at a cost of about $42. Since the update would be available free of charge from my dealer in 14 days, I decided to pass on Apple's generosity.

Unless there is a corresponding increase in the base transmission speed of modems and the throughput of packet-switching networks, this trend bodes ill for the commercial information services and their subscribers. Under present circumstances, many hobbyists are willing to spend half an hour downloading a 48K program at 300 bps and pay $2.50 for the privilege. But how many of them will be willing to cough up $12 an hour to download bloated code for their new, increasingly more voracious computers? In my view, simple economics will force many hobbyists to abandon the commercial services and rely more and more on local, privately owned bulletin board systems and user groups for public domain software and personal networking.

What's Needed?

How fast is fast enough? 2400 bps is generally regarded as a stopgap measure. If modems and the commercial services are to keep pace with the increased demands of 16-bit machines, they will need to support 9600 bps and perhaps even 19,200 bps on regular voice grade lines. Pacific Telephone and several other firms will reportedly bring 19.2K bps technology to the consumer market by early 1988. How the commercial services will see fit to charge for such data rates is anybody's guess. The cost of upgrading existing packet networks to support higher speeds may prove prohibitively expensive.

But the telephone line isn't the only communications link into the American home. Millions of households are already wired for cable television—a medium that can bring you 9600 bps communications for a cost of about $20 per month. We'll look into that next month. ©

The Beginners Page

C Regena

The Many Faces Of PRINT

I am happy to be taking over "The Beginner's Page" from Tom Halfhill, who has assumed new responsibilities as editor of COMPUTE!'s Atari ST Disk & Magazine. Since buying my first computer in 1980, I have written hundreds of BASIC programs and have accumulated several newer machines (most recently, an Atari ST). So I have been a "beginner" several times. My goal for this column is to help you learn to program in BASIC on your own computer—and to enjoy doing it. Although each brand of computer has its own quirks, all versions of BASIC share many similarities; this column will focus on broad concepts that apply to all home computers.

This month let's look at one of the most important commands—the PRINT statement. PRINT used by itself prints a blank line on the screen. PRINT may be followed by items to be printed, either variables (using string variable or numeric variable names) or constants (actual numbers, or characters enclosed in quotation marks). You may also print the product of a BASIC function, such as the tangent of an angle or a segment of a string. Many computers allow you to abbreviate the keyword PRINT with a question mark (?).

Printing Multiple Items

If you include more than one item in a PRINT statement, the items may be separated by a special character—usually a comma or semicolon—known as a *delimiter*. Try these commands:

```
PRINT "HELLO","FRIENDS"
PRINT "ME";"AND";"YOU"
```

Notice the difference in the results. On most computers, the comma positions the next item in the next print column. The column width is predefined (different types of computers may use different column widths). The semicolon prints one item right after the other. If you need spaces between words, you can include a space inside the quotation marks as shown here:

```
PRINT "ME";" AND ";"YOU"
```

In some versions of BASIC, you can print multiple items without any delimiters at all, which is the same as using a semicolon. On Commodore computers, for instance, the statement PRINT A$"HI" works the same as PRINT A$;"HI".

When a delimiter falls at the end of a PRINT statement, it affects the next PRINT statement. This method is useful when you want to print something that doesn't fit conveniently into one program line.

```
100 FOR T=1 TO 5
110 READ N$
120 PRINT N$;" ";
130 NEXT T
140 DATA BO,BILL,JOHN,JIMMY,RI
    CHARD
```

Printing Functions

The TAB function mimics the operation of a tab key on a conventional typewriter, allowing you to move to a certain column before printing. The number in parentheses indicates the column where printing begins (some computers start with column 0; others start with column 1). Here are some examples:

```
PRINT TAB(8);"INDENT TO HERE"
PRINT TAB(5);L$;TAB(15);F$
PRINT TAB(T);A;TAB(T+8);B;TAB(
    T+16);C
```

Some computers let you skip screen lines by using a large value with TAB. For example, on a 40-column Commodore computer the statement TAB(85) skips two 40-column lines and indents five spaces. When you print numeric values, keep in mind that the computer adds space before the number to allow for a sign. If the number is negative, a minus sign (—) appears before the number. If the number is positive, an extra blank space appears. If you use TAB with a numeric value, don't forget to allow for these extra spaces.

You may prefer to move the cursor by printing actual spaces. The SPC function prints the number of spaces indicated by the value in parentheses. The difference between TAB and SPC is that TAB usually moves the cursor column without printing anything in the intervening area, but SPC prints spaces.

```
PRINT"SCORE";SPC(5);SC
PRINT "JEFF";SPC(8);"JILL"
PRINT TAB(T);X$;SPC(14);Y$
```

Closely related to the SPC function is the SPACE$ function—available in more advanced BASICs like those for the IBM, Amiga, and Atari ST—which creates a string consisting of the number of spaces specified in parentheses.

```
S$=SPACE$(15)
PRINT "ONE";S$;"TWO"
```

A string made by SPACE$ can also be concatenated (combined) with other strings.

```
S$="ONE"+SPACE$(20)+"TWO"
PRINT S$
```

STRING$ is another useful function of the more advanced versions of BASIC. It works like SPACE$, but allows you to create a string using any ASCII character. The first value enclosed in parentheses is the number of characters desired in the string, and the second item can be either an ASCII value or a character inside quotation marks. For example, you can print a string of 12 asterisks with either STRING$(12,42) or STRING $(12,"*"). ©

ST Outlook

Philip I. Nelson, Assistant Editor

The New ST BASIC

We recently got an advance look at the new ST BASIC, which, at the time of this writing (July), is still under development by the British firm of MetaComCo. The BASIC itself isn't available, but we have a copy of the manual which describes the new language in detail. The new BASIC will be called MCC BASIC. It retains all the existing BASIC keywords (so it can run ST BASIC programs) and adds a number of new ones. Here's a brief rundown of the more interesting new keywords:

ASK MOUSE, ASK RGB. ASK MOUSE reads the mouse cursor's screen position and button status. ASK RGB tells you what RGB (Red, Green, and Blue) values are currently assigned to a given palette color. RGB (without ASK) redefines a palette color.

BOX. Draws an open or filled box shape.

DRAW, DRAWMODE. The DRAW statement draws a polyline (series of connected lines) defined by a group of *x,y*–coordinate pairs. DRAWMODE controls what happens when you draw over an existing shape.

LINEPAT. For line-drawing operations, selects a system line pattern (solid, dotted, and so on) or a user-defined pattern.

PATTERN. Selects a pattern for fill operations.

GSHAPE, SSHAPE. SSHAPE saves a specified screen area in an array and GSHAPE puts the stored shape on the screen in any location (similar to GET and PUT in IBM BASICA or SSHAPE and GSHAPE in Commodore BASIC 7.0).

MAT AREA, MAT DRAW, MAT LINEF, MAT SOUND. The first three commands perform polyline draw and fill operations (MAT LINEF duplicates MAT DRAW). MAT SOUND causes the ST's sound daemon (processor) to execute sound commands stored in a BASIC array. MAT stands for *matrix*, another name for an array.

GEMDOS, BIOS, XBIOS. Used to call GEMDOS, BIOS, or XBIOS operating system routines from BASIC, much as VDISYS and GEMSYS call VDI and AES routines.

GEM_ADDRIN, GEM_ADDROUT, GEM_CONTRL, GEM_GLOBAL, GEM_INTIN, GEM_INTOUT. Reserved variables that pass information between BASIC and the operating system when calling AES routines with GEMSYS.

STATUS. Reserved variable which returns information (often an error code marking success or failure) after you call a system routine.

Evolution, Not Revolution

On paper, MCC BASIC looks respectable. It offers mouse control, enhanced graphics and sound support, and more convenient access to system routines. But will it be good enough to make BASIC a predominant language for the ST?

Some might question the decision to go with a jazzed-up version of the existing BASIC rather than a completely new implementation. There's something to be said for compatibility. However, it's no secret that a goodly number of ST owners—particularly those who own other computers—are less than enthusiastic about ST BASIC. MCC BASIC fills some of the more glaring gaps in ST BASIC, but it appears to represent an evolutionary, not a revolutionary, change. There are still many jobs that can only be done by programming at the machine level—using system calls rather than BASIC commands.

A second, perhaps more important, question is whether MCC BASIC will stick with ST BASIC's clumsy editor and windowing scheme or replace it with something more convenient. The history of the Commodore 64 and eight-bit Ataris illustrates the value of a good editor. In both cases, many of the computer's best features are available from BASIC only if you program at the lowest level of the machine—by POKEing hardware registers. But both computers are very popular with BASIC programmers, due in no small part to their excellent full-screen BASIC editors. If you make the *process* of programming easy, even unsophisticated programmers enjoy using the computer enough to forgive the fact that BASIC contains some holes.

Interestingly, MetaComCo also wrote ABASIC, the BASIC shipped with the earliest Amigas. As soon as Microsoft's Amiga BASIC became available, Commodore-Amiga scrapped ABASIC and made Amiga BASIC the standard. For anyone who bought an early Amiga, moving from ABASIC to Amiga BASIC was like being given a sleek new sportscar in exchange for a clunky go-kart. ABASIC was better than no BASIC at all, but its primitive, line-oriented editor was a throwback to the earliest days of personal computing. Patterned closely after Microsoft BASIC for the Macintosh, Amiga BASIC has a powerful (some would say, luxurious) editor and ranks with Mac BASIC as one of the most complete implementations of BASIC for any microcomputer.

Are ST owners in for a similar treat? Only the release of MCC BASIC will answer that question. While we await that event, I'd like to know what you think of ST BASIC and what topics you'd like me to cover in this column. Address your comments to me, in care of COMPUTE!, 324 West Wendover Ave., Greensboro, NC 27408. ©

Donald B. Trivette

Root Computing

In about 1742, a small band of Pennsylvania Indians murdered a settler and his wife and kidnapped their infant daughter. A short time later the Indians boldly rode into the village of Pennington, New Jersey, where the Reverend James Davenport recognized that something was amiss. He and his wife traded the Indians a jug of wine and a loaf of bread for the child and christened her Deliverance Paine—Deliverance for her rescue and Paine for Mrs. Davenport's maiden name. Deliverance grew to womanhood and married her school teacher, William Paisley, Jr., in November 1763. She and William moved south to settle in what is now Greensboro, North Carolina. They raised six sons and two daughters. Deliverance died in 1818 and her husband died four years later.

Deliverance and William Paisley are my great-great-great-great-grandparents. I came across that and lots of other family lore recently when I began researching and recording my ancestors.

Computer Genealogy

Paul Andereck, in his book *Computer Genealogy* (Ancestry Press, 1985), describes several pieces of software available for maintaining family records. He favors three programs for the IBM PC: *Roots II* by CommSoft ($195), *Family Roots* by Quinsept ($185), and *Personal Ancestral File*, written and distributed by the Church of Jesus Christ of Latter-day Saints ($35). After using all three programs for several days, I prefer *Personal Ancestral File*. However, my objections to the other two are more personal than substantive, so don't reject them automatically if you're in the market for genealogical software.

Though its price is quite low, *Personal Ancestral File* is a solid piece of software. And it's simple to use, which may be more important for a genealogy program than for other types of software. Even a computer novice should have no difficulty using this program.

Personal Ancestral File is driven by an old-fashioned numerical menu and each screen is clearly labeled so that you're never lost. Option 1 on the main menu selects data entry, which is the prime function of any genealogy program. For each person in the family tree, you may enter sex, surname, three given names, and both dates and locations for birth, death, christening, and burial. You may also enter notes of any length for any individual. For instance, the first paragraph in this column is the note I included in the record for Deliverance Paine.

After recording the information for Deliverance, I added William Paisley, Jr., and then selected the ADD FAMILY option. This allowed me to pair up Deliverance and William, enter their date and place of marriage, and record their eight children. While this is a convenient way to work—beginning with the older ancestors and working forward in time—*Personal Ancestral File* does not demand that you follow this order. You may add all individuals and pair them into families and children later.

Flexible Data Entry

One nice feature is that the program lets you enter dates in almost any order. The form day/month/year is evidently the conventional form, though all of my records were dated in the form month/day/year. *Personal Ancestral File* converted 1-31-1958 into 31 JAN 1958.

A feature that you may not enjoy as much is this program's obsession with accuracy. You can't simply enter *Deliverance* and then proceed. The program beeps and asks you to type Deliverance again. If you spell the name the same way both times, it is entered in the program's dictionary and thereafter you may enter the name without having to verify it. This feature slows down data entry, but it does reduce errors.

Once your family is entered, there are many ways to use the data. Option 6 on the main menu lets you print data in several forms, including a descendants list, indented by generation, and pedigree chart (often called a tree). Or, suppose you want to retrieve some information: You can search the database by any field. Perhaps you remember your grandmother talking about an aunt Chat but you can't remember who Chat was. *Personal Ancestral File* looks through all the records and displays the one for your great-great-aunt Chat (provided, of course, that you entered such a record in the first place). One of the program's more interesting features is the ability to compute the relationship of any two people in the database. It traces back through the chain until it finds an ancestor common to both individuals, then consults a built-in table to find the relationship.

The minimum configuration for running the IBM version of *Personal Ancestral File* is a 256K MS-DOS computer with 80-column monitor and two disk drives. Apple II and CP/M versions are also available. For those who are interested in customizing the program, the Church also plans to release the source code (Microsoft C) for a nominal fee. To obtain a copy of the program, you must request an order form by calling or writing:

Genealogical Library
35 N. West Temple
Salt Lake City, UT 84150
(801) 531-2331

Getting Online

Any computer can become an information appliance with the addition of a modem. Hayes-compatible 1200-baud modems can be bought for under $200 now. You may find one small complication when connecting a modem to your Amiga. When purchasing a cable to connect the modem to your Amiga, you must pay close attention to the types of plugs on the cable. The Amiga serial port connector—where you plug in the modem cable—is the gender opposite that of the IBM serial port. (The Amiga port uses a female connector while the IBM uses a male.) Since IBM-style modem cables are more common than Amiga modem cables, you may find it simpler to use an IBM cable with a *gender-changer* module. I'm using one with my Amiga at home. A gender-changer is a small box that attaches to the female plug on the end of the modem cable, terminating in a male connection that plugs into the female connector on the Amiga. Be aware, though, that there is voltage on pins 14, 21, and 23 on the Amiga port, although these pins are not normally used in most RS-232 cables. Check your modem manual to make sure these pins are not connected or grounded on your modem's connector.

When using a direct-connect modem, you are required to call your local phone company to register the modem, as it becomes part of the phone system when you plug it in. Have at hand the FCC registration and ringer equivalence numbers, usually found on the bottom of the modem or in the manual.

Next comes terminal software. In its simplest form, this is a program that monitors the modem for input—displaying it on your screen—and checks the keyboard for your typing, sending it out over the phone lines. The Amiga BASIC "Extras" disk contains a simple terminal program in the BasicDemos folder. More complex terminal programs allow you to transmit a file (uploading) or store incoming data to disk (downloading).

Error-free And Automatic

Programs such as XMODEM allow error-free file transmission. XON/XOFF allows either computer to pause when necessary without missing any characters. Advanced modem software lets you create scripts to automate the process of calling a remote computer, entering your password, and seeking and downloading information—even if you aren't there to monitor your computer.

What can you do with a modem? First, you can call up local bulletin boards, including Amiga-specific ones. These boards offer services where callers discuss everything from the nuts and bolts of computing to controversial political issues. Usually, there are also public-domain programs for you to download. It's expected you'll upload some of your own programs in exchange.

Then there are the commercial information services such as CompuServe, The Source, Delphi, and GEnie. These services provide information such as stock quotes, daily news/weather/sports, and online encyclopedias and books. Via electronic mail, you can send and receive letters directly over the phone. Most of these services let you play games with other users. The popular CB simulation allows dozens of callers to talk via keyboard in a conversational free-for-all. You can also shop by phone, make airline and ticket reservations—even buy and sell commodities.

Always a popular part of these services is the forum specific to your machine. All these services have Commodore or Amiga forums, containing databases of the most popular public-domain software. The forums allow you to exchange messages with other members. It's like belonging to an electronic user group. It's a great way to get help with a problem—just send a question and you'll likely be surprised by how many answers you get.

The Twenty-first Century And Beyond

Perhaps the most powerful option you have with an *autoanswer* modem—one that can pick up the phone and establish a connection automatically when called by another modem—is to set up your own bulletin board. You can buy bulletin board software or download public-domain programs to help manage your own information service. You are the host here, providing your time and equipment to set up a local communications network. Callers will download software and expect to find interesting things to download. Of course, you must insure that you offer only noncopyrighted, public-domain software on your board. If in doubt, leave it out. (Programs published in most magazines, COMPUTE! included, are *not* public domain.) A public bulletin board is a great way to meet people.

Technology is now significantly expanding our communications; we live in an age where we can have our own computers and hook them into a global intelligence net, offering the greatest possibilities yet for personal expression and free choice. Although there are limitations, telecommunication offers us a hint of what life will be like as the global village becomes a reality in the twenty-first century, and beyond.

INSIGHT: Atari

Bill Wilkinson

A Special RAMdisk For The 800XL

This is a continuation of my August column, wherein I discussed some of the ins and outs of memory bank selection on a 130XE computer and gave you a means of referring to your RAMdisk as something other than D8:. At the end of that article, I promised that the September issue would talk about why a 130XE has only 126K bytes of RAM, and other oddities. As you probably noticed, I got sidetracked last month. I hope you didn't mind too much my reminiscing, and I promise to get back to work with this issue.

In fact, let's start working now: You'll recall that I had posed the question "Is there a way to use the extra 16K memory of the 800XL as a RAMdisk?" My answer was a hesitant yes, because it isn't easy (it took me a relatively long time to prepare this article). For example, the extra memory of the XL is located from $C000 to $FFFF (the top 16K bytes of the 6502's address space), which is the same space used by the OS ROMs and the I/O hardware registers (another instance of bank selection). What's wrong with that, you ask? Why can't I just turn off the ROMs and I/O registers and start using the underlying RAM?

With Frightening Regularity

Well, to start with, any time an interrupt occurs, the 6502 looks in some locations in the top of memory (between $FFFA and $FFFF) to find the address of the routine which will process the interrupt. If we have turned off the OS in order to use the extra RAM, those locations surely will contain garbage. And interrupts occur on Atari computers with frightening regularity: once every 1/60 second for screen refresh, once every time a display list interrupt is encountered, once for each key press; the list goes on.

Still there are more problems. Remember all those references in the August issue to 62K of RAM and 126K of RAM, when you would expect the figures to be 64K and 128K? Well, it turns out that, even if we disable the OS ROMs in order to access the extra RAM, there is no way to disable the hardware I/O space (which occupies addresses $D000 through $D7FF). There simply is *no* RAM in these 2K. Period. So we are down to 14K of hard-to-use RAM with a nasty hole in the middle of it.

Any more nasties to contend with? Yes. When your Atari is displaying text of any kind (GRAPHICS 0, 1, or 2, or the text window in other modes), the ANTIC chip gets the shapes of the characters to display from one of two character sets in ROM (American version at location $E000, international set at $CC00). If we turn off the ROMs, either we must first copy the character sets to RAM (thus decreasing usable RAM still further) or we must turn them off only while no characters are being displayed (for example, during the vertical blank interval).

And let's throw in one more monkey wrench: With all versions of DOS 2, including DOS 2.5, the VTOC (Volume Table Of Contents) sector and the directory sectors are smack-dab in the middle of a 720-sector disk. That means they use sector numbers 360 through 368. Hmmm—if we have a 16K RAMdisk, we have 128 simulated sectors. And 360 is bigger than 128. *Kablooey.*

A Tall Order

So, without major surgery, DOS 2.5 cannot use the 800XL's extra RAM as even a small RAMdisk. Work to be done includes (1) changing DOS 2.5's RAMdisk handler to use a different 16K range of memory; (2) fixing the bank select logic so that it turns the OS ROMs on and off instead of actually selecting banks; (3) somehow changing the RAMdisk initialization code so that it knows we have only one bank of RAM and that even that bank has a 2K hole in it; (4) somehow moving the simulated VTOC and directory sectors into our limited 14K (112 pseudo-sector) range; (5) disabling all interrupts while we access the RAM; and (6) only accessing the RAM during the vertical blank interval.

Whew. Tall order, no? The only easy task here is item 6. When we first worked on DOS 2.5, the 130XE hardware had this same restriction, and there is still a flag buried in DOS 2.5 which tells it to wait for the vertical blank period before doing its simulated sector I/O.

Well, the listing accompanying this article does all of the above. When you enter and run this program, it creates a new version of RAMDISK.COM, the special boot file that DOS 2.5 uses, which indeed gives you a 14K RAMdisk. The program is only for 800XL owners, and only for DOS 2.5. It won't work with any other combination of computer or DOS. The program overwrites the existing RAMDISK.COM file on the DOS disk, so be sure you have a backup if you want to keep a copy of the original file.

Some other cautions are also in order:

1. *Don't* hit the RESET key while the RAMdisk is active. This is a sure way to scramble the contents of the RAMdisk.

2. *Don't* try to format the RAMdisk (and this means don't use a BASIC program which uses XIO 254). This version of RAMDISK.COM cheats a little: Because of the need for making a hole in the middle of the pseudodisk where the I/O

registers are, and because we have to insure that the directory area is within the 16K bounds, we have to tell DOS that some sectors on the disk are already in use. We do this by modifying the VTOC of the RAMdisk *after* it has been formatted. If you reformat the RAMdisk, DOS may try to use those nonexistent pseudosectors and crash your computer.

3. This is a *very* small RAMdisk. If you use it, you'll find 105 free sectors is the maximum. Even to get that figure, I cheated: I allowed only 3 sectors for the directory instead of the customary 8, so you can have a maximum of 24 files on this RAMdisk (probably still overkill). However, DOS does not know about this limitation, and you can crash the system by creating 25 files.

4. *Don't* use DOS's Write DOS Files menu command after booting with the RAMDISK.COM created here. This program actually puts patches right in the middle of DOS, and trying to use an ordinary RAMdisk with the patched DOS could be disastrous.

Although the program here is written in BASIC and creates the RAMDISK.COM file directly, I've made the original assembly language source code available on CompuServe under the filename RAM14K.ASM in the Utilities section of the DownLoad libraries (also known as DL3). I know I promised to do that with the 1027 printer fixer program back in June, but the file never appeared. The explanation is sad, but simple: The disk with my June program on it went bad shortly after I wrote the article. Let that be a lesson: Back up *everything*. I promise to back up this program many times over.

Also, here's an idea for improving this program: It turns out that a total of 105 sectors is 18 sectors greater than the minimum needed to put DUP.SYS and MEM.SAV on the RAMdisk. So why not do so and aid the performance of DOS 2.5 tremendously? The source code is on CompuServe, so have at it.

Finally, there is an error in the 1027 printer fixer listing in my column in the June issue. Line 210 should read:

```
210 OPEN #3,MODE,0,"D:AUTORUN
    .SYS"
```

The error is mine; I gave a test version to COMPUTE! instead of the final one, hence the name "AUTOTEST" in the listing in June.

```
HN 1000 REM This program cre
        ates a
NJ 1010 REM DOS 2.5 RAMDISK.
        COM file
MK 1020 REM for 800XL owners
         to allow
ML 1030 REM use of RAM under
         OS ROMs
GO 1040 REM as a small (105
        sector)
GD 1050 REM RAMdisk.
KL 1060 REM
BE 1070 OPEN #1,8,0,"D:RAMDI
        SK.COM"
BC 1100 READ BYTE
BQ 1110 IF BYTE>=0 THEN PUT
        #1,BYTE:CKSUM=CKSUM+
        BYTE:GOTO 1100
BH 1120 CLOSE #1:IF CKSUM<>1
        5523 THEN PRINT "ERR
        OR IN DATA STATEMENT
        S":STOP
JM 1130 END
LC 5000 DATA 255,255,223,7,2
        23,7,0,128
EP 5010 DATA 7,128,7,8,137,1
        1,137,11
EK 5020 DATA 8,63,21,63,21,4
        9,141,20
KO 5030 DATA 157,20,201,3,14
        4,4,40,160
PK 5040 DATA 139,96,32,203,1
        8,165,67,74
PB 5050 DATA 74,9,192,222,18
        ,235,18,106
KO 5060 DATA 106,106,8,173,1
        ,211,74,40
IC 5070 DATA 42,141,1,211,96
        ,0,128,58
LE 5080 DATA 128,173,10,7,9,
        128,141,10
OP 5090 DATA 7,32,224,7,162,
        112,169,254
JI 5100 DATA 157,66,3,169,55
        ,157,68,3
FM 5110 DATA 169,128,157,69,
        3,169,0,157
FP 5120 DATA 74,3,157,75,3,3
        2,86,228
GN 5130 DATA 48,13,160,74,18
        5,0,129,145
PO 5140 DATA 69,136,16,248,3
        2,148,16,96
GB 5150 DATA 68,56,58,0,0,12
        9,73,129
GI 5160 DATA 2,105,0,105,0,0
        ,0,0
BF 5170 DATA 0,0,15,255,255,
        255,0,0
MG 5180 DATA 255,255,255,255
        ,255,255,255,15
OA 5190 DATA 255,255,128,0,0
        ,0,0,0
JF 5200 DATA 0,0,0,0,0,0,0,0
JG 5210 DATA 0,0,0,0,0,0,0,0
JH 5220 DATA 0,0,0,0,0,0,0,0
JI 5230 DATA 0,0,0,0,0,0,0,0
JJ 5240 DATA 0,0,0,0,0,0,0,0
NK 5250 DATA 0,0,224,2,225,2
        ,0,128
EI 5260 DATA -1,(END OF DATA
        )
```

©

Apple Hex War

There is an error in line 1140 of the Apple version of this game from the July issue (Program 5, p. 50). The last statement in that line should be NEXT L, not MEXT L. This should not have caused problems except in very long games where many armies were moved onto the playing grid. ©

COMPUTE's Author Guide

Most of the following suggestions serve to improve the speed and accuracy of publication. COMPUTE! is primarily interested in new and timely articles on the Commodore 64/128, Atari, Apple, IBM PC/PCjr, Amiga, and Atari ST. We are much more concerned with the content of an article than with its style, but articles should be clear and well-explained.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one make of computer, please state the brand name and, if applicable, the BASIC or ROM or DOS version(s) involved. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name, the title of the article, and, if applicable, the BASIC/ROM/DOS version(s). Atari tapes should specify whether they are to be LOADed or ENTERed. We prefer to receive Apple programs on disk rather than tape. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, TAB, ESC, SHIFT), BASIC words (LIST, RND, GOTO), and three languages (BASIC, APL, PILOT). Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE! pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403) it will take from four to eight weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE! does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact the Review Coordinator for details.

COMPUTE!'s Guide To Typing In Programs

Computers are precise—type the program *exactly* as listed, including necessary punctuation and symbols, except for special characters noted below. We have provided a special listing convention as well as a program to check your typing—"The Automatic Proofreader."

Programs for the IBM, TI-99/4A, and Atari ST models should be typed exactly as listed; no special characters are used. Programs for Commodore, Apple, and Atari 400/800/XL/XE computers may contain some hard-to-read special characters, so we have a listing system that indicates these control characters. You will find these Commodore and Atari characters in curly braces; *do not type the braces*. For example, {CLEAR} or {CLR} instructs you to insert the symbol which clears the screen on the Atari or Commodore machines. A complete list of these symbols is shown in the tables below. For Commodore, Apple, and Atari, a single symbol by itself within curly braces is usually a control key or graphics key. If you see {A}, hold down the CONTROL key and press A. This will produce a reverse video character on the Commodore (in quote mode), a graphics character on the Atari, and an invisible control character on the Apple.

Graphics characters entered with the Commodore logo key are enclosed in a special bracket: [<A>]. In this case, you would hold down the Commodore logo key as you type A. Our Commodore listings are in uppercase, so shifted symbols are underlined. A graphics heart symbol (SHIFT-S) would be listed as S. One exception is {SHIFT-SPACE}. When you see this, hold down SHIFT and press the space bar. If a number precedes a symbol, such as {5 RIGHT}, {6 S}, or [<8 Q>], you would enter five cursor rights, six shifted S's, or eight Commodore-Q's. On the Atari, inverse characters (white on black) should be entered with the inverse video

Atari 400/800/XL/XE

When you see	Type	See
{CLEAR}	ESC SHIFT <	Clear Screen
{UP}	ESC CTRL -	Cursor Up
{DOWN}	ESC CTRL =	Cursor Down
{LEFT}	ESC CTRL +	Cursor Left
{RIGHT}	ESC CTRL *	Cursor Right
{BACK S}	ESC DELETE	Backspace
{DELETE}	ESC CTRL DELETE	Delete character
{INSERT}	ESC CTRL INSERT	Insert character
{DEL LINE}	ESC SHIFT DELETE	Delete line
{INS LINE}	ESC SHIFT INSERT	Insert line
{TAB}	ESC TAB	TAB key
{CLR TAB}	ESC CTRL TAB	Clear tab
{SET TAB}	ESC SHIFT TAB	Set tab stop
{BELL}	ESC CTRL 2	Ring buzzer
{ESC}	ESC ESC	ESCape key

Commodore PET/CBM/VIC/64/128/16/+4

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL 9	
{OFF}	CTRL 0	
{BLK}	CTRL 1	
{WHT}	CTRL 2	
{RED}	CTRL 3	
{CYN}	CTRL 4	
{PUR}	CTRL 5	
{GRN}	CTRL 6	
{BLU}	CTRL 7	
{YEL}	CTRL 8	

When You Read:	Press:	See:
[<1>]	COMMODORE 1	
[<2>]	COMMODORE 2	
[<3>]	COMMODORE 3	
[<4>]	COMMODORE 4	
[<5>]	COMMOOORE 5	
[<6>]	COMMOOORE 6	
[<7>]	COMMOOORE 7	
[<8>]	COMMOOORE 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	
←	←	

key (Atari logo key on 400/800 models).

Whenever more than two spaces appear in a row, they are listed in a special format. For example, {6 SPACES} means press the space bar six times. Our Commodore listings never leave a single space at the end of a line, instead moving it to the next printed line as {SPACE}.

Amiga program listings contain only one special character, the left arrow (←) symbol. This character marks the end of each program line. Wherever you see a left arrow, press RETURN or move the cursor off the line to enter that line into memory. Don't try to type in the left arrow symbol; it's there only as a marker to indicate where each program line ends.

The Automatic Proofreader

Type in the appropriate program listed below, then save it for future use. The Commodore Proofreader works on the Commodore 128, 64, Plus/4, 16, and VIC-20. Don't omit any lines, even if they contain unfamiliar commands or you think they don't apply to your computer. When you run the program, it installs a machine language program in memory and erases its BASIC portion automatically (so be sure to save several copies before running the program for the first time). If you're using a Commodore 128, Plus/4 or 16, do *not* use any GRAPHIC commands while the Proofreader is active. You should disable the Commodore Proofreader before running any other program. To do this, either turn the computer off and on or enter SYS 64738 (for the 64), SYS 65341 (128), SYS 64802 (VIC-20), or SYS 65526 (Plus/4 or 16). To reenable the Proofreader, reload the program and run it as usual. Unlike the original VIC/64 Proofreader, this version works the same with disk or tape.

On the Atari, run the Proofreader to activate it (the Proofreader remains active in memory as a machine language program); you must then enter NEW to erase the BASIC loader. Pressing SYSTEM RESET deactivates the Atari Proofreader; enter PRINT USR(1536) to reenable it.

The Apple Proofreader erases the BASIC portion of itself after you run it, leaving only the machine language portion in memory. It works with either DOS 3.3 or ProDOS. Disable the Apple Proofreader by pressing CTRL-RESET before running another BASIC program.

The IBM Proofreader is a BASIC program that simulates the IBM BASIC line editor, letting you enter, edit, list, save, and load programs that you type. Type RUN to activate. Be sure to leave Caps Lock on, except when typing lowercase characters.

Once the Proofreader is active, try typing in a line. As soon as you press RETURN, either a hexadecimal number (on the Apple) or a pair of letters (on the Commodore, Atari, or IBM) appears. The number or pair of letters is called a *checksum*.

Compare the value displayed on the screen by the Proofreader with the checksum printed in the program listing in the magazine. The checksum is given to the left of each line number. Just type in the program a line at a time (without the printed checksum), press RETURN or Enter, and compare the checksums. If they match, go on to the next line. If not, check your typing; you've made a mistake. Because of the checksum method used, do not type abbreviations, such as ? for PRINT. On the Atari and Apple Proofreaders, spaces are not counted as part of the checksum, so be sure you type the right number of spaces between quote marks. The Atari Proofreader does not check to see that you've typed the characters in the right order, so if characters are transposed, the checksum still matches the listing. The Commodore Proofreader catches transposition errors and ignores spaces unless they're enclosed in quotation marks. The IBM Proofreader detects errors in spacing and transposition.

IBM Proofreader Commands

Since the IBM Proofreader replaces the computer's normal BASIC line editor, it has to include many of the direct-mode IBM BASIC commands. The syntax is identical to IBM BASIC. Commands simulated are LIST, LLIST, NEW, FILES, SAVE, and LOAD. When listing your program, press any key (except Ctrl-Break) to stop the listing. If you enter NEW, the Proofreader prompts you to press Y to be especially sure you mean yes.

Two new commands are BASIC and CHECK. BASIC exits the Proofreader back to IBM BASIC, leaving the Proofreader in memory. CHECK works just like LIST, but shows the checksums along with the listing. After you have typed in a program, save it to disk. Then exit the Proofreader with the BASIC command, and load the program as usual (this replaces the Proofreader in memory). You can now run the program, but you may want to resave it to disk. This will shorten it on disk and make it load faster, but it can no longer be edited with the Proofreader. If you want to convert an existing BASIC program to Proofreader format, save it to disk with SAVE *"filename"*,A.

Program 1: Atari Proofreader

By Charles Brannon, Program Editor

```
100 GRAPHICS 0
110 FOR I=1536 TO 1700:REA
    D A:POKE I,A:CK=CK+A:N
    EXT I
120 IF CK<>19072 THEN ? "E
    rror in DATA Statement
    s.  Check Typing.":END

130 A=USR(1536)
140 ? :? "Automatic Proofr
    eader Now Activated."
150 END
160 DATA 104,160,0,185,26,
    3,201,69,240,7
170 DATA 200,200,192,34,20
    8,243,96,200,169,74
180 DATA 153,26,3,200,169,
    6,153,26,3,162
190 DATA 0,189,0,228,157,7
    4,6,232,224,16
200 DATA 208,245,169,93,14
    1,78,6,169,6,141
210 DATA 79,6,24,173,4,228
    ,105,1,141,95
220 DATA 6,173,5,228,105,0
    ,141,96,6,169
230 DATA 0,133,203,96,247,
    238,125,241,93,6
240 DATA 244,241,115,241,1
    24,241,76,205,238
250 DATA 0,0,0,0,0,32,62,2
    46,8,201
260 DATA 155,240,13,201,32
    ,240,7,72,24,101
270 DATA 203,133,203,104,4
    0,96,72,152,72,138
280 DATA 72,160,0,169,128,
    145,88,200,192,40
290 DATA 208,249,165,203,7
    4,74,74,74,24,105
300 DATA 161,160,3,145,88,
    165,203,41,15,24
310 DATA 105,161,200,145,8
    8,169,0,133,203,104
320 DATA 170,104,168,104,4
    0,96
```

Program 2: IBM Proofreader

By Charles Brannon, Program Editor

```
10 'Automatic Proofreader Vers
   ion 3.0 (Lines 205,206 adde
   d/190 deleted/470,490 chang
   ed from V2.0)
100 DIM L$(500),LNUM(500):COLO
    R 0,7,7:KEY OFF:CLS:MAX=0:
    LNUM(0)=65536!
110 ON ERROR GOTO 120:KEY 15,C
    HR$(4)+CHR$(70):ON KEY(15)
     GOSUB 640:KEY (15) ON:GOT
    O 130
120 RESUME 130
130 DEF SEG=&H40:W=PEEK(&H4A)
140 ON ERROR GOTO 650:PRINT:PR
    INT"Proofreader Ready."
150 LINE INPUT L$:Y=CSRLIN-INT
    (LEN(L$)/W)-1:LOCATE Y,1
160 DEF SEG=0:POKE 1050,30:POK
    E 1052,34:POKE 1054,0:POKE
     1055,79:POKE 1056,13:POKE
     1057,28:LINE INPUT L$:DEF
     SEG:IF L$="" THEN 150
170 IF LEFT$(L$,1)=" " THEN L$
    =MID$(L$,2):GOTO 170
```

```
1Ø0 IF VAL(LEFT$(L$,2))=Ø AND
    MID$(L$,3,1)=" " THEN L$=M
    ID$(L$,4)
2Ø0 IF ASC(L$)>57 THEN 26Ø 'no
    line number, therefore co
    mmand
2Ø5 BL=INSTR(L$," "):IF BL=Ø T
    HEN BL$=L$:GDTO 2Ø6 ELSE B
    L$=LEFT$(L$,BL-1)
2Ø6 LNUM=VAL(BL$):TEXT$=MID$(L
    $,LEN(STR$(LNUM))+1)
21Ø IF TEXT$="" THEN GOSUB 54Ø
    :IF LNUM=LNUM(P) THEN GDSU
    B 56Ø:GDTD 15Ø ELSE 15Ø
22Ø CK5UM=Ø:FDR I=1 TD LEN(L$)
    :CKSUM=(CKSUM+ASC(MID$(L$,
    I))*I) AND 2SS:NEXT:LDCATE
    Y,1:PRINT CHR$(65+CKSUM/1
    6)+CHR$(6S+(CKSUM AND 1S))
    +" "+L$
23Ø GDSUB 54Ø:IF LNUM(P)=LNUM
    THEN L$(P)=TEXT$:GOTO 15Ø
    'replace line
24Ø GDSUB SBØ:GDTD 15Ø 'insert
    the line
26Ø TEXT$="":FDR I=1 TO LEN(L$
    ):A=A5C(MID$(L$,I)):TEXT$=
    TEXT$+CHR$(A+32*(A>96 ANO
    A<123)):NEXT
27Ø DELIMITER=IN5TR(TEXT$," ")
    :COMMAND$=TEXT$:ARG$="":IF
    DELIMITER THEN CDMMAND$=L
    EFT$(TEXT$,DELIMITER-1):AR
    G$=MIO$(TEXT$,DELIMITER+1)
    ELSE DELIMITER=IN5TR(TEXT
    $,CHR$(34)):IF DELIMITER T
    HEN CDMMANO$=LEFT$(TEXT$,D
    ELIMITER-1):ARG$=MIO$(TEXT
    $,OELIMITER)
2B0 IF CDMMAND$<>"LI5T" THEN 4
    1Ø
29Ø OPEN "scrn:" FDR DUTPUT AS
    #1
3ØØ IF ARG$="" THEN FIR5T=Ø:P=
    MAX-1:GDTD 34Ø
31Ø DELIMITER=IN5TR(ARG$,"-"):
    IF OELIMITER=Ø THEN LNUM=V
    AL(ARG$):GOSUB 54Ø:FIR5T=P
    :GOTO 34Ø
32Ø FIR5T=VAL(LEFT$(ARG$,DELIM
    ITER)):LA5T=VAL(MID$(ARG$,
    OELIMITER+1))
33Ø LNUM=FIRST:GD5UB 54Ø:FIR5T
    =P:LNUM=LAST:GD5UB S4Ø:IF
    P=Ø THEN P=MAX-1
34Ø FDR X=FIR5T TD P:N$=MID$(5
    TR$(LNUM(X)),2)+" "
3S0 IF CKFLAG=Ø THEN A$="":GDT
    D 37Ø
36Ø CK5UM=Ø:A$=N$+L$(X):FOR I=
    1 TD LEN(A$):CKSUM=(CK5UM+
    ASC(MID$(A$,I))*I) AND 255
    :NEXT:A$=CHR$(65+CK5UM/16)
    +CHR$(65+(CK5UM AND 15))+"
    "
37Ø PRINT #1,A$+N$+L$(X)
3B0 IF INKEY$<>"" THEN X=P
39Ø NEXT :CLDSE #1:CKFLAG=Ø
4ØØ GDTO 13Ø
41Ø IF CDMMAND$="LLI5T" THEN D
    PEN "Ipt1:" FDR DUTPUT A5
    #1:GDTD 3ØØ
42Ø IF CDMMAND$="CHECK" THEN C
    KFLAG=1:GOTO 29Ø
43Ø IF CDMMAND$<>"SAVE" THEN 4
    5Ø
44Ø GD5UB 6ØØ:DPEN ARG$ FDR DU
    TPUT A5 #1:ARG$="":GDTD 3Ø
    Ø
4S0 IF COMMAND$<>"LDAD" THEN 4
    9Ø
46Ø GDSUB 6ØØ:DPEN ARG$ FOR IN
    PUT AS #1:MAX=Ø:P=Ø
47Ø WHILE NDT EOF(1):LINE INPU
    T #1,L$:BL=INSTR(L$," "):B
    L$=LEFT$(L$,BL-1):LNUM(P)=
    VAL(BL$):L$(P)=MIO$(L$,LEN
    (STR$(VAL(BL$)))+1):P=P+1:
    WEND
4B0 MAX=P:CLD5E #1:GOTD 13Ø
49Ø IF CDMMAND$="NEW" THEN INP
    UT "Erase program - Are yo
    u sure";L$:IF LEFT$(L$,1)=
    "y" DR LEFT$(L$,1)="Y" THE
    N MAX=Ø:LNUM(Ø)=65536':GDT
    O 13Ø:ELSE 13Ø
5ØØ IF CDMMAND$="BASIC" THEN C
    DLDR 7,Ø,Ø:DN ERROR GDTO Ø
    :CLS:END
51Ø IF CDMMAND$<>"FILES" THEN
    52Ø
515 IF ARG$="" THEN ARG$="A:"
    ELSE 5EL=1:GOSUB 6ØØ
517 FILES ARG$:GDTD 13Ø
52Ø PRINT"Syntax error":GDTD 1
    3Ø
54Ø P=Ø:WHILE LNUM>LNUM(P) AND
     P<MAX:P=P+1:WEND:RETURN
56Ø MAX=MAX-1:FDR X=P TD MAX:L
    NUM(X)=LNUM(X+1):L$(X)=L$(
    X+1):NEXT:RETURN
S8Ø MAX=MAX+1:FDR X=MAX TD P+1
     STEP -1:LNUM(X)=LNUM(X-1)
    :L$(X)=L$(X-1):NEXT:L$(P)=
    TEXT$:LNUM(P)=LNUM:RETURN
6ØØ IF LEFT$(ARG$,1)<>CHR$(34)
    THEN S2Ø EL5E ARG$=MID$(A
    RG$,2)
61Ø IF RIGHT$(ARG$,1)=CHR$(34)
     THEN ARG$=LEFT$(ARG$,LEN(
    ARG$)-1)
62Ø IF SEL=Ø AND INSTR(ARG$,".
    ")=Ø THEN ARG$=ARG$+".BAS"
63Ø 5EL=Ø:RETURN
64Ø CLD5E #1:CKFLAG=Ø:PRINT"St
    opped.":RETURN 15Ø
65Ø PRINT "Error #";ERR:RE5UME
     15Ø
```

Program 3: Commodore Proofreader

By Philip Nelson, Assistant Editor

```
1Ø VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
2Ø PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
3Ø IF VEC=5Ø556 THEN PRINT "VI
   C-2Ø"
4Ø IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
5Ø IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
6Ø SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
7Ø FOR J=Ø TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
8Ø IF CHK<>2Ø57Ø THEN PRINT "*
    ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
9Ø FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:H8=INT(RS/256):LB=
   RS-(256*HB)
1ØØ CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
11Ø IF CHK<>22Ø54 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
12Ø POKE SA+149,PEEK(772):POKE
    SA+15Ø,PEEK(773)
13Ø IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
14Ø PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
15Ø POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,Ø:N
   EW
16Ø DATA 12Ø,169,73,141,4,3,16
   9,3,141,5,3
17Ø DATA 88,96,165,2Ø,133,167,
   165,21,133,168,169
18Ø DATA Ø,141,Ø,255,162,31,18
   1,199,157,227,3
19Ø DATA 2Ø2,16,248,169,19,32,
   21Ø,255,169,18,32
2ØØ DATA 21Ø,255,16Ø,Ø,132,18Ø
   ,132,176,136,23Ø,18Ø
21Ø DATA 2ØØ,185,Ø,2,24Ø,46,2Ø
   1,34,2Ø8,8,72
22Ø DATA 165,176,73,255,133,17
   6,1Ø4,72,2Ø1,32,2Ø8
23Ø DATA 7,165,176,2Ø8,3,1Ø4,2
   Ø8,226,1Ø4,166,18Ø
24Ø DATA 24,165,167,121,Ø,2,13
   3,167,165,168,1Ø5
25Ø DATA Ø,133,168,2Ø2,2Ø8,239
   ,24Ø,2Ø2,165,167,69
26Ø DATA 168,72,41,15,168,185,
   211,3,32,21Ø,255
27Ø DATA 1Ø4,74,74,74,74,168,1
   85,211,3,32,21Ø
28Ø DATA 255,162,31,189,227,3,
   149,199,2Ø2,16,248
29Ø DATA 169,146,32,21Ø,255,76
   ,86,137,65,66,67
3ØØ DATA 68,69,7Ø,71,72,74,75,
   77,8Ø,81,82,83,88
31Ø DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

Program 4: Apple Proofreader

By Tim Victor, Editorial Programmer

```
1Ø C = Ø: FDR I = 76B TD 76B +
   68: READ A:C = C + A: PDKE I
   ,A: NEXT
2Ø IF C < > 7258 THEN PRINT "ER
   RDR IN PRDDFREADER DATA STAT
   EMENTS": END
3Ø IF PEEK (19Ø * 256) < > 76 T
   HEN PDKE 56,Ø: PDKE 57,3: CA
   LL 1ØØ2: GDTD 5Ø
4Ø PRINT CHR$ (4);"IN#A$3ØØ"
5Ø PDKE 34,Ø: HDME : PDKE 34,1:
    VTAB 2: PRINT "PRDDFREADER
   INSTALLED"
6Ø NEW
1ØØ DATA 216,32,27,253,2Ø1,141
11Ø DATA 2Ø8,6Ø,13B,72,169,Ø
12Ø DATA 72,1B9,255,1,2Ø1,16Ø
13Ø DATA 24Ø,B,1Ø4,1Ø,125,255
14Ø DATA 1,1Ø5,Ø,72,2Ø2,2Ø8
15Ø DATA 23B,1Ø4,17Ø,41,15,9
16Ø DATA 48,2Ø1,5B,144,2,233
17Ø DATA 57,141,1,4,13B,74
1B0 DATA 74,74,74,41,15,9
19Ø DATA 48,2Ø1,58,144,2,233
2ØØ DATA 57,141,Ø,4,1Ø4,17Ø
21Ø DATA 169,141,96
```

MLX Machine Language Entry Program For Commodore 64 and Apple

Ottis Cowper, Technical Editor and Tim Victor, Editorial Programmer

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. The Apple version runs on the II, II+, IIe, and IIc, with either DOS 3.3 or ProDOS.

"MLX" is a new way to enter long machine language (ML) programs without a lot of fuss. MLX lets you enter the numbers from a special list that looks similar to BASIC DATA statements. It checks your typing on a line-by-line basis. It won't let you enter invalid characters or let you continue if there's a mistake in a line. It won't even let you enter a line or digit out of sequence. For the Commodore 64, this new version of MLX was first introduced in the December 1985 issue. No version of 64 MLX published before that date can be used to enter the MLX-format listings in this issue.

Using MLX

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!). Program 1 is for the Commodore 64, and Program 2 is for the Apple. For Apple MLX, it doesn't matter whether you save the program on a disk formatted for DOS 3.3 or ProDOS. Programs entered with Apple MLX, however, must be saved to a disk formatted with the same operating system as MLX itself. If you have an Apple IIe or IIc, make sure that the key marked *Caps Lock* is in the down position.

When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing. If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, the 64 version will offer you the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session. In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. In the 64 version, if you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" machine language listings you may be accustomed to, the extra checksum number on the end allows MLX to check your typing. (Apple users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, the data is added to the workspace area, and the prompt for the next line of data appears (the 64 version gives a pleasant beep to indicate that the line was entered correctly). But if MLX detects a typing error, you'll be notified of the mistake. The 64 version will sound a low buzz and display an error message, then redisplay the line for editing. Apple MLX sounds a beep to alert you of the error and then erases the incorrect line and prompts you to reenter it correctly.

After you have entered the last number on the last line of the listing, the Apple version will return to the command menu. At this point you should immediately choose the option S to save your data. The 64 version automatically moves to the Save option after the last number is entered.

Invalid Characters Banned

In 64 MLX, only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; the new MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; the new MLX automatically enters and checks the line after you type the last digit.

Apple MLX is fairly flexible about how you type in the numbers. You can put extra spaces between numbers or leave the spaces out entirely, compressing a line into 18 keypresses. But be careful not to put a space between two digits in the middle of a number. MLX will read two single-digit numbers instead of one two-digit number (F 6 means F *and* 6, not F6). You must press RETURN to enter the line.

Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), nothing happens (the 64 version gives a warning buzz to indicate an invalid keypress). Even better, MLX checks for transposed characters. If you're supposed to type in *A0* and instead enter *0A*, MLX will catch your mistake.

Editing Features

To correct typing mistakes before finishing a line in the 64 version, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line number prompt.

More editing features are available when correcting lines in which 64 MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the

screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Apple MLX also includes some editing features. The left- and right-arrow keys allow you to back up and go forward on the line you're entering so that you can retype data. Pressing the CONTROL (CTRL) and D keys at the same time (*delete*) removes the character under the cursor, shortening the line by one character. Pressing CONTROL-I (*insert*) puts a space under the cursor and shifts the rest of the line to the right, making the line one character longer. If the cursor is at the right end of the line, neither CONTROL-D nor CONTROL-I has any effect. To leave Enter mode, press the RETURN key when MLX prompts you with a new line address.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. With Apple MLX, you can stop the display and return to the menu by pressing any key. The 64 version allows you to stop the display and get back to the menu by pressing RETURN, or to pause the display by pressing the space bar (press space again to restart the display).

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE (SAVE DATA in the 64 version) and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. The 64 version will follow this by asking you to press either D or T to select disk or tape.

Those using the 64 version will notice the disk drive starting and stopping several times during a load or save. Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands. Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750), so this should *not* be included when entering the name. (This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name.)

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports any errors detected during the save or load. For the 64 version, the standard disk or tape error messages will be displayed. (Tape users should bear in mind that the Commodore 64 is never able to detect errors when saving to tape.) The 64 version also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The Apple version simply displays the message DISK ERROR if a problem is detected during a Save or Load. If you're not sure why a disk error has occurred, check the drive. Make sure there's a formatted disk in the drive and that it was formatted by the same operating system you're using for MLX (ProDOS or DOS 3.3). If you're trying to save a file and see an error message, the disk might be full. Either save the file on another disk or quit MLX (by pressing the Q key), delete an old file or two, then run MLX again. Your typing should still be safe in memory. If the error message appears during a Load, you may have specified a filename that doesn't exist on the disk.

The Quit menu option has the obvious effect—it stops MLX and enters BASIC. In the 64 version the RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP–RESTORE for the 64 or CONTROL-RESET for the Apple also gets you out.) The 64 version will ask for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option in 64 MLX.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some Commodore 64 ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk or LOAD *"filename"* for tape, and then RUN. (Such programs usually have 0801 as their MLX starting address.) Others must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. (On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000.) In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program. For the Apple, you need to BRUN the program, or you may BLOAD and start the program with a CALL. Again, refer to the article accompanying the machine language program for instructions.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you'll have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

In the Apple version, line 100 traps all errors to line 610. If MLX is typed in correctly, then only disk errors should normally be encountered. A disk error

message when you're not trying to access the drive—for example, when you first start entering data—indicates a typing error in the MLX program itself. If this occurs, hit CONTROL-RESET to break out of MLX and carefully compare your entry against the printed listing.

For instructions on entering these listings, please refer to "COMPUTE!'s Guide to Typing In Programs" in this issue of COMPUTE!.

Program 1: MLX For Commodore 64

Version by Ottis Cowper, Technical Editor

```
100 POKE 56,50:CLR:DIM IN$,I,J
    ,A,B,A$,B$,A(7),N$ :rem 34
110 C4=48:C6=16:C7=7:Z2=2:Z4=2
    54:Z5=255:Z6=256:Z7=127
                       :rem 238
120 FA=PEEK(45)+Z6*PEEK(46):BS
    =PEEK(55)+Z6*PEEK(56):H$="
    0123456789ABCDEF" :rem 11B
130 R$=CHR$(13):L$="{LEFT}":S$
    =" ":D$=CHR$(20):Z$=CHR$(0
    ):T$="{13 RIGHT}" :rem 173
140 SD=54272:FOR I=SD TO SD+23
    :POKE I,0:NEXT:POKE SD+24,
    15:POKE 788,52     :rem 194
150 PRINT"{CLR}"CHR$(142)CHR$(
    8):POKE 532B0,15:POKE 532B
    1,15               :rem 104
160 PRINT T$" {RED}{RVS}
    {2 SPACES}[B @3{2 SPACES}"
    SPC(28)"{2 SPACES}{OFF}
    {BLU} MLX II {RED}{RVS}
    {2 SPACES}"SPC(28)"
    {12 SPACES}{BLU}" :rem 121
170 PRINT"{3 DOWN}{3 SPACES}CO
    MPUTE!'S MACHINE LANGUAGE
    {SPACE}EDITOR{3 DOWN}"
                       :rem 135
180 PRINT"{BLK}STARTING ADDRES
    S[43";:GOSUB300:SA=AD:GOSU
    B1040:IF F THEN1B0:rem 113
190 PRINT"{BLK}{2 SPACES}ENDIN
    G ADDRESS[43";:GOSUB300:EA
    =AD:GOSUB1030:IF F THEN190
                       :rem 173
200 INPUT"{3 DOWN}{BLK}CLEAR W
    ORKSPACE [Y/N][43";A$:IF L
    EFT$(A$,1)<>"Y"THEN220
                        :rem 9
210 PRINT"{2 DOWN}{BLU}WORKING
    ...";:FORI=BS TO BS+EA-SA+
    7:POKE I,0:NEXT:PRINT"DONE
    "                  :rem 139
220 PRINTTAB(10)"{2 DOWN}{BLK}
    {RVS} MLX COMMAND MENU
    {DOWN}[43":PRINT T$"{RVS}E
    {OFF}NTER DATA"    :rem 62
230 PRINT T$"{RVS}D{OFF}ISPLAY
     DATA":PRINT T$"{RVS}L
    {OFF}OAD DATA"     :rem 19
240 PRINT T$"{RVS}S{OFF}AVE FI
    LE":PRINT T$"{RVS}Q{OFF}UI
    T{2 DOWN}{BLK}"    :rem 238
250 GET A$:IF A$=N$ THEN250
                       :rem 127
260 A=0:FOR I=1 TO 5:IF A$=MID
    $("EDLSQ",I,1)THEN A=I:I=5
                       :rem 42
270 NEXT:ON A GOTO420,610,690,
    700,280:GOSUB1060:GOTO250
                       :rem 97
280 PRINT"{RVS} QUIT ":INPUT"
    {DOWN}[43ARE YOU SURE [Y/N
    ]";A$:IF LEFT$(A$,1)<>"Y"T
    HEN220             :rem 189
290 POKE SD+24,0:END   :rem 95
300 IN$=N$:AD=0:INPUTIN$:IFLEN
    (IN$)<>4THENRETURN :rem 31
310 B$=IN$:GOSUB320:AD=A:B$=MI
    D$(IN$,3):GOSUB320:AD=AD*2
    56+A:RETURN        :rem 225
320 A=0:FOR J=1' TO 2:A$=MID$(B
    $,J,1):B=ASC(A$)-C4+(A$>"@
    ")*C7:A=A*C6+B     :rem 143
330 IF B<0 OR B>15 THEN AD=0:A
    =-1:J=2            :rem 132
340 NEXT:RETURN        :rem 240
350 B=INT(A/C6):PRINT MID$(H$,
    B+1,1);:B=A-B*C6:PRINT MID
    $(H$,B+1,1);:RETURN:rem 42
360 A=INT(AD/Z6):GOSUB350:A=AD
    -A*Z6:GOSUB350:PRINT":";
                       :rem 32
370 CK=INT(AD/Z6):CK=AD-Z4*CK+
    Z5*(CK>Z7):GOTO390:rem 131
3B0 CK=CK*Z2+Z5*(CK>Z7)+A
                       :rem 168
390 CK=CK+Z5*(CK>Z5):RETURN
                       :rem 159
400 PRINT"{DOWN}STARTING AT[43
    ";:GOSUB300:IF IN$<>N$ THE
    N GOSUB1030:IF F THEN400
                       :rem 75
410 RETURN             :rem 117
420 PRINT"{RVS} ENTER DATA ":G
    OSUB400:IF IN$=N$ THEN220
                       :rem 85
430 OPEN3,3:PRINT      :rem 34
440 POKE198,0:GOSUB360:IF F TH
    EN PRINT IN$:PRINT"{UP}
    {5 RIGHT}";        :rem 6
450 FOR I=0 TO 24 STEP 3:B$=S$
    :FOR J=1 TO 2:IF F THEN B$
    =MID$(IN$,I+J,1)   :rem 226
460 PRINT"{RVS}"B$L$;:IF I<24T
    HEN PRINT"{OFF}";  :rem 15
470 GET A$:IF A$=N$ THEN470
                       :rem 135
480 IF(A$>"/"ANDA$<":")OR(A$>"
    @"ANDA$<"G")THEN540
                       :rem 100
490 IF A$=R$ AND((I=0)AND(J=1)
    OR F)THEN PRINT B$;:J=2:NE
    XT:I=24:GOTO550    :rem 46
500 IF A$="{HOME}" THEN PRINT
    {SPACE}B$:J=2:NEXT:I=24:NE
    XT:F=0:GOTO440     :rem 66
510 IF(A$="{RIGHT}")ANDF THENP
    RINT B$L$;:GOTO540:rem 107
520 IF A$<>L$ AND A$<>D$ OR((I
    =0)AND(J=1))THEN GOSUB1060
    :GOTO470           :rem 232
530 A$=L$+S$+L$:PRINT B$L$;:J=
    2-J:IF J THEN PRINT L$;:I=
    I-3                :rem 12
540 PRINT A$;:NEXT J:PRINT S$;
                       :rem 2
550 NEXT I:PRINT:PRINT"{UP}
    {5 RIGHT}";:INPUT#3,IN$:IF
     IN$=N$ THEN CLOSE3:GOTO22
    0                  :rem 106
560 FOR I=1 TO 25 STEP3:B$=MID
    $(IN$,I):GOSUB320:IF I<25
    {SPACE}THEN GOSUB380:A(I/3
    )=A                :rem B1
570 NEXT:IF A<>CK THEN GOSUB10
    60:PRINT"{BLK}{RVS} ERROR:
     REENTER LINE [43":F=1:GOT
    0440               :rem 161
580 GOSUB1080:B=BS+AD-SA:FOR I
    =0 TO 7:POKE B+I,A(I):NEXT
                       :rem 245
590 AD=AD+8:IF AD>EA THEN CLOS
    E3:PRINT"{DOWN}{BLU}** END
     OF ENTRY **{BLK}{2 DOWN}"
    :GOTO700           :rem 207
600 F=0:GOTO440        :rem 84
610 PRINT"{CLR}{DOWN}{RVS} DIS
    PLAY DATA ":GOSUB400:IF IN
    $=N$ THEN220       :rem 146
620 PRINT"{DOWN}{BLU}PRESS:
    {RVS}SPACE{OFF} TO PAUSE,
    {SPACE}{RVS}RETURN{OFF} TO
     BREAK[43{DOWN}"   :rem 241
630 GOSUB360:B=BS+AD-SA:FORI=B
    TO B+7:A=PEEK(I):GOSUB350:
    GOSUB380:PRINT S$; :rem 56
640 NEXT:PRINT"{RVS}";:A=CK:GO
    SUB350:PRINT       :rem 144
650 F=1:AD=AD+B:IF AD>EA THENP
    RINT"{DOWN}{BLU}** END OF
    {SPACE}DATA **":GOTO220
                       :rem 170
660 GET A$:IF A$=R$ THEN GOSUB
    1080:GOTO220       :rem 65
670 IF A$=S$ THEN F=F+1:GOSUB1
    080                :rem 28
680 ONFGOTO630,660,630:rem 224
690 PRINT"{DOWN}{RVS} LOAD DAT
    A ":OP=1:GOTO710   :rem 31
700 PRINT"{DOWN}{RVS} SAVE FIL
    E ":OP=0           :rem 32
710 IN$=N$:INPUT"{DOWN}FILENAM
    E[43";IN$:IF IN$=N$ THEN22
    0                  :rem 229
720 F=0:PRINT"{DOWN}{BLK}{RVS}
    T{OFF}APE OR {RVS}D{OFF}IS
    K: [43";           :rem 66
730 GET A$:IF A$="T"THEN PRINT
    "T{DOWN}":GOTOBB0  :rem 90
740 IF A$<>"D"THEN730  :rem 90
750 PRINT"D{DOWN}":OPEN15,8,15
    ,"I0:":B=EA-SA:IN$="0:"+IN
    $:IF OP THEN810    :rem 163
760 OPEN 1,8,8,IN$+",P,W":GOSU
    BB60:IF A THEN220  :rem 66
770 AH=INT(SA/256):AL=SA-(AH*2
    56):PRINT#1,CHR$(AL);CHR$(
    AH);               :rem 221
780 FOR I=0 TO B:PRINT#1,CHR$(
    PEEK(BS+I));:IF ST THEN800
                       :rem 171
790 NEXT:CLOSE1:CLOSE15:GOTO94
    0                  :rem 230
800 GOSUB1060:PRINT"{DOWN}
    {BLK}ERROR DURING SAVE:[43
    ":GOSUB860:GOTO220 :rem 61
B10 OPEN 1,8,8,IN$+",P,R":GOSU
    B860:IF A THEN220  :rem 57
820 GET#1,A$,B$:AD=ASC(A$+Z$)+
    256*ASC(B$+Z$):IF AD<>SA T
    HEN F=1:GOTO850    :rem 155
B30 FOR I=0 TO B:GET#1,A$:POKE
     BS+I,ASC(A$+Z$):IF ST AND
    (I<>B)THEN F=2:AD=I:I=B
                       :rem 180
B40 NEXT:IF ST<>64 THEN F=3
                       :rem 20
B50 CLOSE1:CLOSE15:ON ABS(F>0)
    +1 GOTO960,970     :rem 12
860 INPUT#15,A,A$:IF A THEN CL
    OSE1:CLOSE15:GOSUB1060:PRI
    NT"{RVS}ERROR: "A$:rem 114
870 RETURN             :rem 127
BB0 POKE183,PEEK(FA+2):POKE1B7
    ,PEEK(FA+3):POKE188,PEEK(F
    A+4):IFOP=0THEN920:rem 178
890 SYS 63466:IF(PEEK(783)AND1
    )THEN GOSUB1060:PRINT"
    {DOWN}{RVS} FILE NOT FOUND
```

```
    ":GOTO690              :rem 34
900 AD=PEEK(829)+256*PEEK(830)
    :IF AD<>SA THEN F=1:GOTO97
    0                      :rem 201
910 A=PEEK(831)+256*PEEK(832)-
    1:F=F-2*(A<EA)-3*(A>EA):AD
    =A-AD:GOTO930          :rem 75
920 A=SA:B=EA+1:GOSUB1010:POKE
    780,3:SYS 63338        :rem 107
930 A=BS:B=BS+(EA-SA)+1:GOSUB1
    010:ON OP GOTO950:SYS 6359
    1                      :rem 38
940 GOSUB1080:PRINT"{BLU}** SA
    VE COMPLETED **":GOTO220
                           :rem 139
950 POKE147,0:SYS 63562:IF ST<
    >64 THEN970            :rem 39
960 GOSUB10B0:PRINT"{BLU}** LO
    AD COMPLETED **":GOTO220
                           :rem 126
970 GOSUB1060:PRINT"{BLK}{RVS}
    ERROR DURING LOAD:{DOWN}
    {4}":ON F GOSUB980,990,100
    0:GOTO220              :rem 233
980 PRINT"INCORRECT STARTING A
    DDRESS (";:GOSUB360:PRINT"
    )":RETURN              :rem 145
990 PRINT"LOAD ENDED AT ";:AD=
    SA+AD:GOSUB360:PRINT D$:RE
    TURN                   :rem 159
1000 PRINT"TRUNCATED AT ENDING
     ADDRESS":RETURN       :rem 166
1010 AH=INT(A/256):AL=A-(AH*25
    6):POKE193,AL:POKE194,AH
                           :rem 95
1020 AH=INT(B/256):AL=B-(AH*25
    6):POKE174,AL:POKE175,AH:
    RETURN                 :rem 122
1030 IF AD<SA OR AD>EA THEN105
    0                      :rem 135
1040 IF(AD>511 AND AD<40960)OR
    (AD>49151 AND AD<53248)TH
    EN GOSUB10B0:F=0:RETURN
                           :rem 104
1050 GOSUB1060:PRINT"{RVS} INV
    ALID ADDRESS {DOWN}{BLK}"
    :F=1:RETURN            :rem 224
1060 POKE SD+5,31:POKE SD+6,20
    8:POKE SD,240:POKE SD+1,4
    :POKE SD+4,33          :rem 19
1070 FOR S=1 TO 100:NEXT:GOTO1
    090                    :rem 90
1080 POKE SD+5,B:POKE SD+6,240
    :POKE SD,0:POKE SD+1,90:P
    OKE SD+4,17            :rem 1B2
1090 FOR S=1 TO 100:NEXT:POKE
    {SPACE}SD+4,0:POKE SD,0:P
    OKE SD+1,0:RETURN      :rem B
```

Program 2: MLX For Apple

Version by Tim Victor, Editorial Programmer

```
100 N = 9: HOME : NORMAL : PRIN
    T "APPLE MLX": POKE 34,2: O
    NERR  GOTO 610
110 VTAB 1: HTAB 20: PRINT "STA
    RT ADDRESS";: GOSUB 530: IF
     A = 0 THEN  PRINT  CHR$ (7
    ): GOTO 110
120 S = A
130 VTAB 2: HTAB 20: PRINT "END
     ADDRESS  ";: GOSUB 530: IF
     S  = A OR A = 0 THEN  PR
    INT  CHR$ (7): GOTO 130
140 E = A
150 PRINT : PRINT "CHOOSE: (E)NT
    ER DATA";: HTAB 22: PRINT "
    (D)ISPLAY DATA": HTAB 8: PR
    INT "(L)OAD FILE  (S)AVE FI
    LE  (Q)UIT": PRINT
160 GET A$: FOR I = 1 TO 5: IF
    A$ < > MID$ ("EDLSQ",I,1) T
    HEN  NEXT : GOTO 160
170 ON I GOTO 270,220,180,200:
    POKE 34,0: END
180 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BLOAD";A$;",A";S
190 GOTO 150
200 INPUT "FILENAME: ";A$: IF A
    $ <  > "" THEN  PRINT  CHR$
     (4);"BSAVE";A$;",A";S;",L"
    ;E - S
210 GOTO 150
220 GOSUB 590: IF B = 0 THEN 15
    0
230 FOR B = B TO E STEP 8:L = 4
    :A = B: GOSUB 5B0: PRINT A$
    ;": ";:L = 2
240 FOR F = 0 TO 7:V(F + 1) = P
    EEK (B + F): NEXT : GOSUB 5
    60:V(9) = C
250 FOR F = 1 TO N:A = V(F): GO
    SUB 5B0: PRINT A$" ";: NEXT
     : PRINT : IF  PEEK (49152)
    < 128 THEN  NEXT
260 POKE 4916B,0: GOTO 150
270 GOSUB 590: IF B = 0 THEN 15
    0
280 FOR B = B TO E STEP 8
290 HTAB 1:A = B:L = 4: GOSUB 5
    B0: PRINT A$;": ";: CALL 64
    66B:A$ = "":P = 0: GOSUB 33
    0: IF L = 0 THEN 150
300 GOSUB 470: IF F < > N THEN
    PRINT CHR$ (7);: GOTO 290
310 IF N = 9 THEN GOSUB 560: IF
     C < > V(9) THEN PRINT CHR$
     (7);: GOTO 290
320 FOR F = 1 TO 8: POKE B + F
    - 1,V(F): NEXT : PRINT : NE
    XT : GOTO 150
330 IF LEN (A$) = 33 THEN A$ =
    O$:P = O: PRINT CHR$ (7);
340 L = LEN (A$):O$ = A$:O = P:
    L$ = "": IF P > 0 THEN L$ =
      LEFT$ (A$,P)
350 R$ = "": IF P < L - 1 THEN
    R$ =  RIGHT$ (A$,L - P - 1)
360 HTAB 7: PRINT L$;: FLASH :
    IF P < L THEN PRINT MID$ (A
    $,P + 1,1);: NORMAL : PRINT
    R$;
370 PRINT " ";: NORMAL
380 K = PEEK (49152): IF K < 12
    8 THEN 380
390 POKE 4916B,0:K = K - 128
400 IF K = 13 THEN HTAB 7: PRIN
    T A$;" ";: RETURN
410 IF K = 32 OR K > 47 AND K <
     58 OR K > 64 AND K < 71 TH
    EN A$ = L$ + CHR$ (K) + R$:
    P = P + 1
420 IF K = 4 THEN A$ = L$ + R$
430 IF K = 9 THEN A$ = L$ + " "
     +  MID$ (A$,P + 1,1) + R$
440 IF K = 8 THEN P = P - (P >
    0)
450 IF K = 21 THEN P = P + (P <
    L)
460 GOTO 330
470 F = 1:O = 0: FOR P = 1 TO L
    EN (A$):C$ = MID$ (A$,P,1):
     IF F > N AND C$ < > " " TH
    EN  RETURN
480 IF C$ < > " " THEN  GOSUB 5
    20:V(F) = J + 16 * (O = 1)
    * V(F):O = O + 1
490 IF O > 0 AND C$ = " " OR O
    = 2 THEN O = 0:F = F + 1
500 NEXT : IF O = 0 THEN F = F
    - 1
510 RETURN
520 J = ASC (C$):J = J - 48 - 7
    * (J > 64): RETURN
530 A = 0: INPUT A$:A$ = LEFT$
    (A$,4): IF LEN (A$) = 0 THE
    N RETURN
540 FOR P = 1 TO LEN (A$):C$ =
    MID$ (A$,P,1): IF C$ < "0"
    OR C$ > "9" AND C$ < "A" OR
     C$ > "Z" THEN A = 0: RETUR
    N
550 GOSUB 520:A = A * 16 + J: N
    EXT : RETURN
560 C = INT (B / 256):C = B - 2
    56 * C - 255 * (C > 127):C
    = C - 255 * (C > 255)
570 FOR F = 1 TO 8:C = C * 2 -
    255 * (C > 127) + V(F):C =
    C - 255 * (C > 255): NEXT :
     RETURN
5B0 I = FRE (0):A$ = "": FOR I
    = 1 TO L:T =  INT (A / 16):
    A$ =  MID$ ("0123456789ABCD
    EF",A - 16 * T + 1,1) + A$:
    A = T: NEXT : RETURN
590 PRINT "FROM ADDRESS ";: GOS
    UB 530: IF S > A OR E < A O
    R A = 0 THEN B = 0: RETURN
600 B = S + B * INT ((A - S) /
    B): RETURN
610 PRINT "DISK ERROR": GOTO 15
    0
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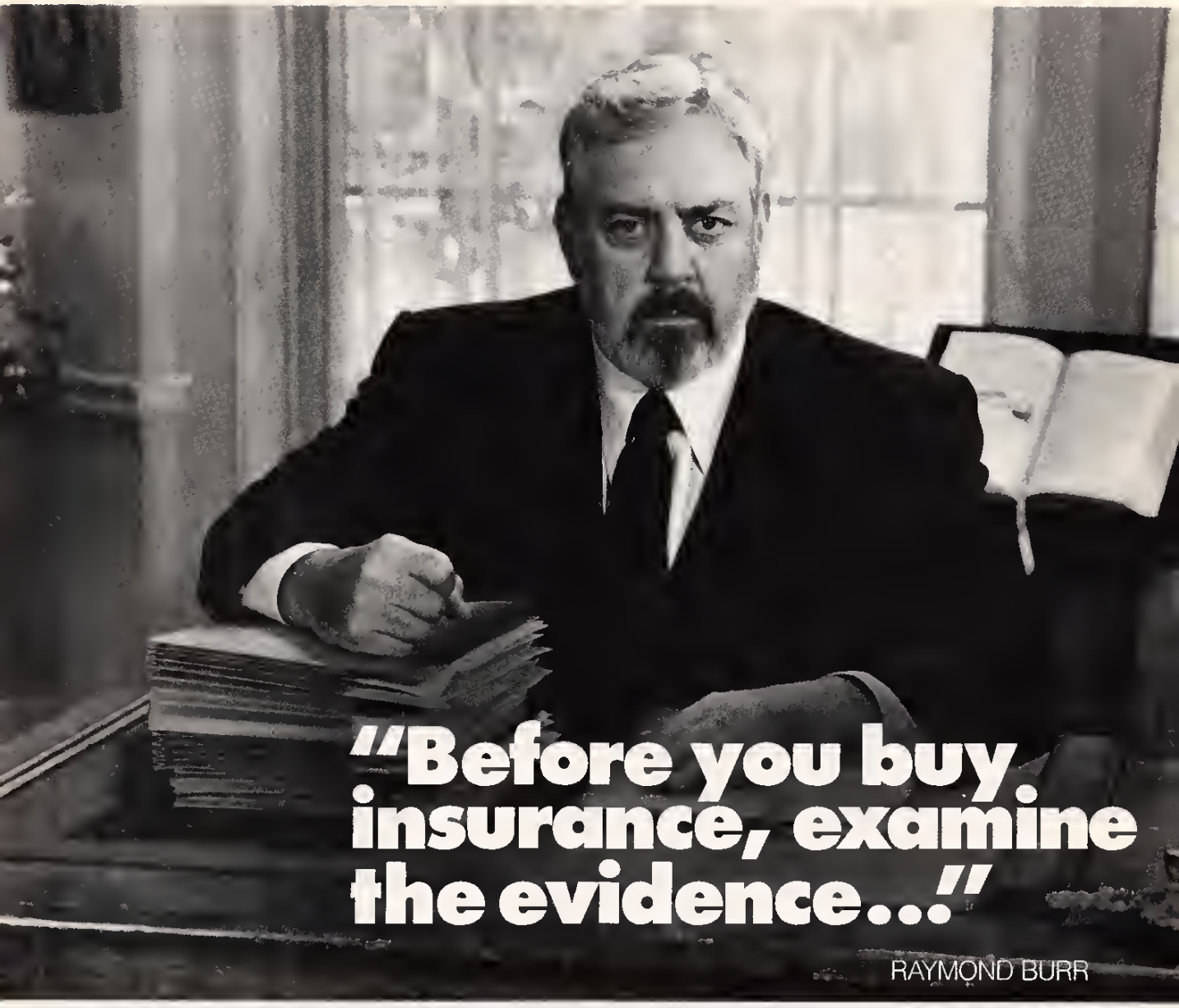

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News & Products

Microsoft Write For ST

Atari Corporation has announced an agreement with Microsoft to offer *Microsoft Write* for the Atari 520ST and 1040ST computers. *Microsoft Write* is based on the Macintosh version of the bestselling *Microsoft Word* word processing program. It takes advantage of the powerful monochrome and color graphics capabilities of the ST computers.

The agreement gives Atari the rights to sell, market, and distribute *Microsoft Write* worldwide.

Atari, 1196 Borregas Ave., Sunnyvale, CA 94086.

Circle Reader Service Number 198.

Eight-Bit Atari World War II Simulation

Rommel: Battles for Tobruk covers four crucial WWII tank battles between the German Afrika Korps and the British 8th Army. This detailed, historically accurate game covers every aspect of the desert war, including individual men, guns, and tanks, as well as minefields, morale, fatigue, supply, air power, and intelligence. A 32-page historical notes booklet is included. After resolving both players' moves simultaneously, *Rommel* displays a strategic map showing a "movie" of everything that happened in the turn.

Rommel can be played against the computer or another human opponent—even by mail or modem. For the Atari eight-bit line, it retails for $40.

Game Designers Workshop, P.O. Box 1646, Bloomington, IL 61702-1646.

Circle Reader Service Number 199.

Brøderbund Educational Program Available For Commodore

Brøderbund has announced that *Where in the World Is Carmen Sandiego?* is now available for the Commodore 64. It's a mystery game in which players track Carmen and her infamous gang of thieves around the world to recover stolen treasures. Players use *The World Almanac* to decipher clues as they chase the thief from continent to continent. The program helps players learn world geography and reference skills in an exciting and challenging game setting.

The Commodore 64 version retails for $34.95.

Brøderbund Software, 17 Paul Dr., San Rafael, CA 94903-2101.

Circle Reader Service Number 200.

Talking Educational Software For Amiga

Speller Bee and *KidTalk* are the first titles in the Talking Notebook Series, a line of talking educational software from First Byte. Each program offers self-contained, unlimited text-to-speech capabilities, using First Byte's *SmoothTalker* speech technology.

Speller Bee improves children's spelling skills by providing them with practice routines, a variety of challenging games, and simulated test situations. The program helps preschool children improve their word recognition skills, and helps students from first grade through junior high levels increase their vocabulary by allowing them to enter their own spelling lists from school. *Speller Bee* is self-paced, making it especially attractive for students who have difficulties in learning, or who need extra spelling practice at home.

KidTalk is a talking word processor that helps children improve their reading and writing skills and guides them in communicating their ideas more effectively. Children learn the relationship between the sight and sound of individual letters, the relationship of letters to words, and that of words to sentences. Like *Speller Bee*, it contains graphics that help make learning more fun. *KidTalk* is also beneficial to young children who don't yet read because it provides them with a way to hear and recognize letters and words.

Each program retails for $59.95.

First Byte, 2845 Temple Ave., Long Beach, CA 90806.

Circle Reader Service Number 201.

Apple, TI Spelling Practice

Students can practice their spelling skills at home or in school with *Spellbound*, a Robinsoft program from Roberts Information Systems. This educational program for the Apple II series, Commodore 64, and TI-99/4A displays words from a list one at a time and waits for the student to type in the correct spelling underneath. Teachers and parents can enter any word list and save it to disk or tape.

Challenge levels make the spelling words disappear from the screen at faster rates so the student learns to spell from memory. Any misspelled words are recalled when the list is completed, and repeated until spelled correctly. When the student successfully spells the whole list, *Spellbound* scrambles the letters of each word and challenges the student to randomly unscramble them for learning reinforcement.

Spellbound keeps a record of successful attempts by each student.

Spellbound is not copy-protected. The Apple II–series version requires Applesoft BASIC, and the TI-99/4A version requires Extended BASIC.

Spellbound is available for $14.95. Schools may buy a site license for an additional $10.00.

Roberts Information Systems, 152 W. 4th, P.O. Box 666, Prineville, OR 97754.

Circle Reader Service Number 202.

New Stickybear Apple Software

Weekly Reader Software has announced four new Stickybear software packages to help youngsters develop reading, math, drawing, and music skills.

Children ages seven and up can be introduced to drawing with *Stickybear Drawing*, a menu-driven program that lets you use freehand DRAW, CIRCLE, BOX, LINES, BRUSHES, and COLORS features to create original pictures. You can erase portions of the picture or use the zoom feature to adjust individual pixels. All pictures can be saved to disk and printed out.

Stickybear Music teaches the fundamentals of music notation and composition to children seven and up. This program lets you compose a piece of music, play it, modify it, and save it to disk for future replay. With a printer, you can print out the composition and see the notes. There's also a music editing system and a selected group of tunes already on the disk.

Teachers or parents can select from over 150 word problems in *Math Word Problems* to drill students ages eight and up in addition, subtraction, multiplication, and division. Plus, you can create your own word problems to suit individual needs. This program allows you to record and print out report sheets for up to 50 students, screen the calculator option, and print out problems for test master sheets.

More than 30 stories are stored on the *Stickybear Reading Comprehension* disk for 8- to 11-year-olds. Each story is followed by reading comprehension questions that automatically adjust to the user's skill level. You can also enter your own stories and questions. All the stories on the disk have been approved by Weekly Reader editors and can be printed out.

Stickybear Drawing, Stickybear Music, Math Word Problems, and *Stickybear Reading Comprehension* all work on the Apple II, II+, IIe, and IIc with 48K memory and DOS 3.3 or higher. Each package includes a disk, user's guide, poster, and Stickybear stickers.

The suggested retail price for each of the packages is $39.95.

Weekly Reader Family Software, 245 Long Hill Rd., Middletown, CT 06457.

Circle Reader Service Number 203.

More ST Software From Michtron

Michtron, one of the first companies to release software for the Atari ST, has introduced several new products.

Cornerman is a desk accessory offering features similar to those in Borland's *Sidekick,* plus a few additional ones. Features include a 16-digit calculator with binary, octal, decimal, and hexadecimal modes, scientific function, display formatting, and a printing tape display; a notepad with automatic word-wrap and automatic time and date stamping for every note you write; a telephone log and dialer; a print function; DOS window for instant access to other programs; and a setup function to customize the display. It retails for $49.95.

The Animator lets you take images from a drawing or painting program and bring them to life through animation. After having created the images you want to use, you design a short movie by selecting which frames to show and when and how long to show them. It retails for $39.95.

Mighty Mail contains an easy-to-use database manager that lets users store in each entry a personal name, a company name, two address lines, city, state, zip code, and a telephone number. There are 16 user-definable flags to mark customer types or mailings. *Mighty Mail* then lets the user print mailing labels or generate reports, using the program's search function. It retails for $49.95.

Michtron, 576 S. Telegraph, Pontiac, MI 48053.

Circle Reader Service Number 204.

Do You Have Tass?

Gramps has disappeared to Tonetown, a bizarre place full of snousers, doods, and tass cits. You have to find Gramps and get tass, because if you don't have tass, you'll be labeled a stupid tourist and booted out of Tonetown. Chaz, the keeper of the 'Tique, can help you up your tass level and improve your mental and physical health. But you have to watch out for Franklin Snarl, the green-scaled, furry, and fanged villain.

Tass Times in Tonetown from Activision combines action and animation into an interactive-fiction adventure game.

Tass Times in Tonetown is available for the Commodore 64/128 for $34.95, for the Apple II series and IBM PC/PCjr for $39.95, and for the Amiga and Macintosh for $44.95.

Activision, 2350 Bayshore Frontage Rd., Mountain View, CA 94043.

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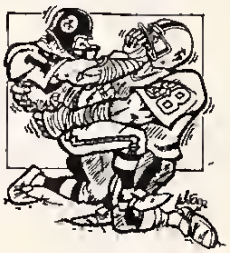

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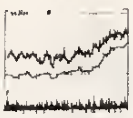

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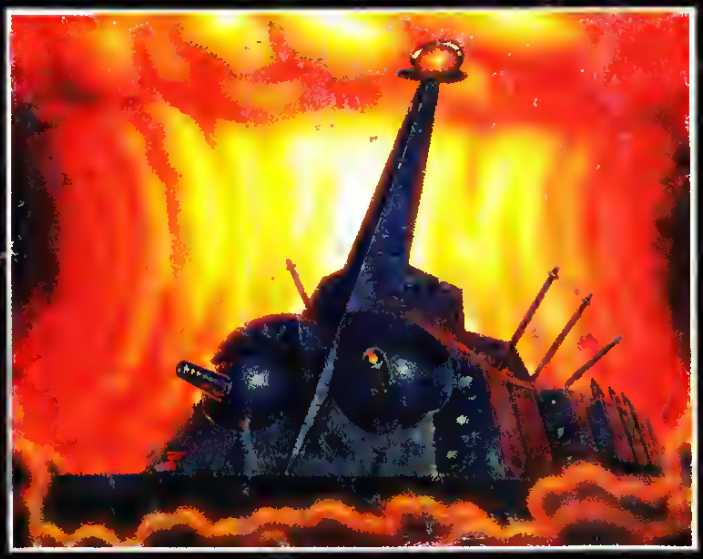

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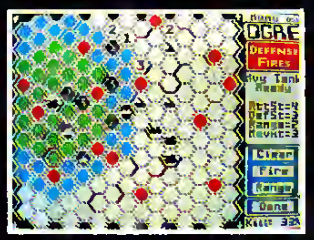

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